September 1973

Smithsonian

Horseman beating off a leopard–from a great show of Chinese treasures now in Europe (p.24)

Do you know your car could have built-in reflexes?

Some drivers will always be better than others. But thanks to advances in electronic technology, *all* drivers will be better some day because their autos will have built-in reflexes.

Drivers will have electronic devices to control skidding, sense highway hazards, provide radar-accuracy speedometers, or even adjust windshield wipers and defrosters to the actual weather conditions. All automatically.

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The electronic way

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Mar. 28 — **Take a fresh look at the Mediterranean on the Grand Spring Cruise of the s.s. Volendam.** 49 days, 29 ports, including Casablanca, Tangier, Izmir, Istanbul, Mykonos, Athens, Brindisi, Cannes, Lisbon. From New York. From Pt. Everglades Mar. 30. $2660 to $8165.

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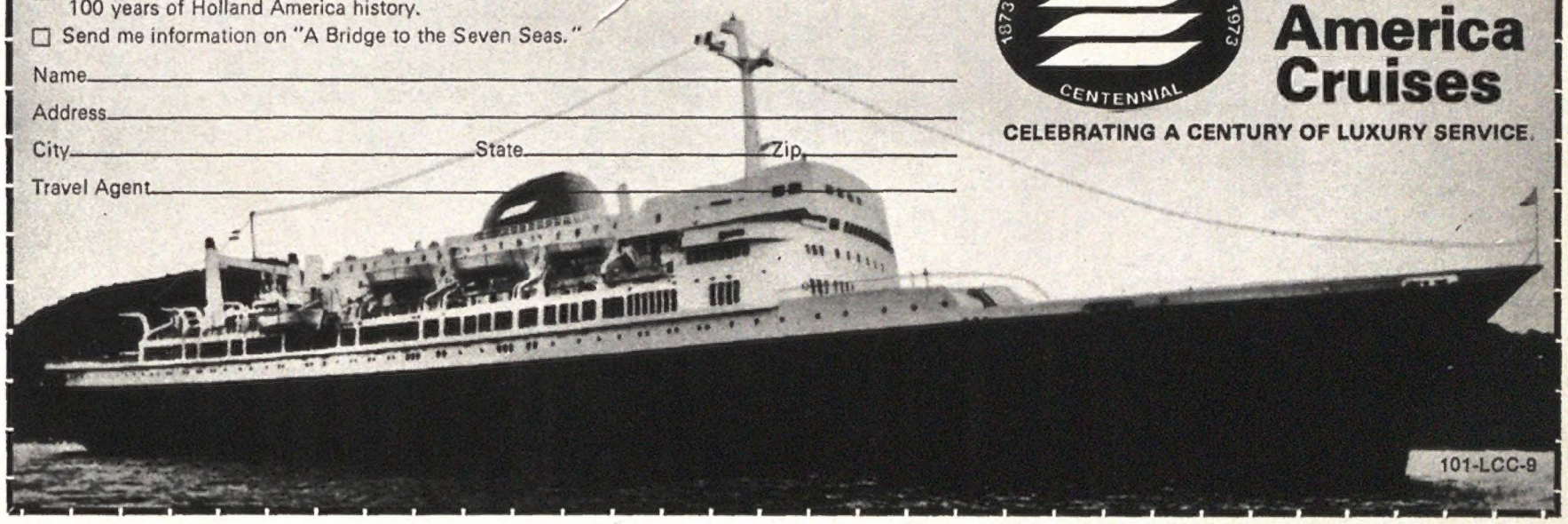

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Smithsonian

Volume 4, Number 6

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Large size (44mm.) Enlarged to show depth and richness of the multiple-struck relief.

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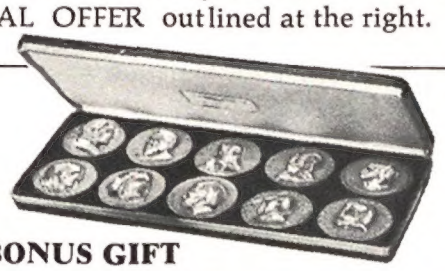

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Secretary Ripley's comments

The view from the castle

As our schools open their doors this fall, it's time for both parents and students to ask what they expect from education today

These are the days when hundreds of thousands of students are going back to schools for various degrees of learning, or entering for the first time the present-day hurly-burly of academe. What are they seeking and what will come of it?

As someone who has taught for years in a university, I have gradually become critical of university assumptions about the universality of education, about that precious uniqueness, that torch of learning passed from generation to generation of teachers, shedding its light on students. Are the students learning knowledge or learning skills? Does education serve merely to provide weapons for competition?

Parents seem to want this: They seek training and the transfer of information which, in their pragmatic view, will enable their children to survive. They seek a kind of trade-school education, now that universal affluence is the ideal and all must go to college to achieve it. After all, our competitive economy and new technologies and scientific discoveries require keen training and the acquisition of special skills.

Meanwhile, students have become deeply emotional about life styles. As Charles Frankel points out in a recent perceptive article in *Science* magazine, the reaction which has so profoundly influenced youth today is essentially a return to the age-old contest between rational and irrational thought. Whenever scientific method and rational thought, generated often by the impetus of wars, reach a crescendo of activity, such accomplishments as atomic power, rocketry and computer techniques emerge. Then there tends to be a countervailing wave of irrationalisms: belief in the intuitive mode, the emotional, the rhapsodic; belief in dreams, in mysticism; desires to rearrange all life styles, to remove oppression, to promote equality and to liberate the human spirit.

Curiously enough, this phenomenon, thought to be moral and "liberal" by so many younger academics and trustingly accepted by so many of the young, is a kind of outgrowth of today's rational requirements of life. The youth culture of irrationalism depends on the advances of science. There are no more deserted islands or idyllic lotus-lands which are not reachable by jet or jeep or overnight camper. Much of the yearning for these goals is merely promoted by the very market place which youth claims to despise.

Someone is going to have to awaken Americans to the truth that today's college experience is something to "take" like a pill. It is a trade-school thing. Education, on the other hand, is a continuous learning process not necessarily acquired with college residence.

I think of the Smithsonian as a continuous learning experience, outside the diploma mill. Certainly it is a place where both the rational and irrational life can be compared with mutual tolerance. Here is where objects may be shown—everything from the paraphernalia of Tantric ritual and its accompanying cerebrations to the assemblage of space flight and the materials for scientific perception of the lineaments of the universe. Like a continuous folk festival, our exhibits can refresh the spirits of Americans, restore their enthusiasm and arouse their interest in being whatever they are, in all their diversity and splendor.

S. Dillon Ripley

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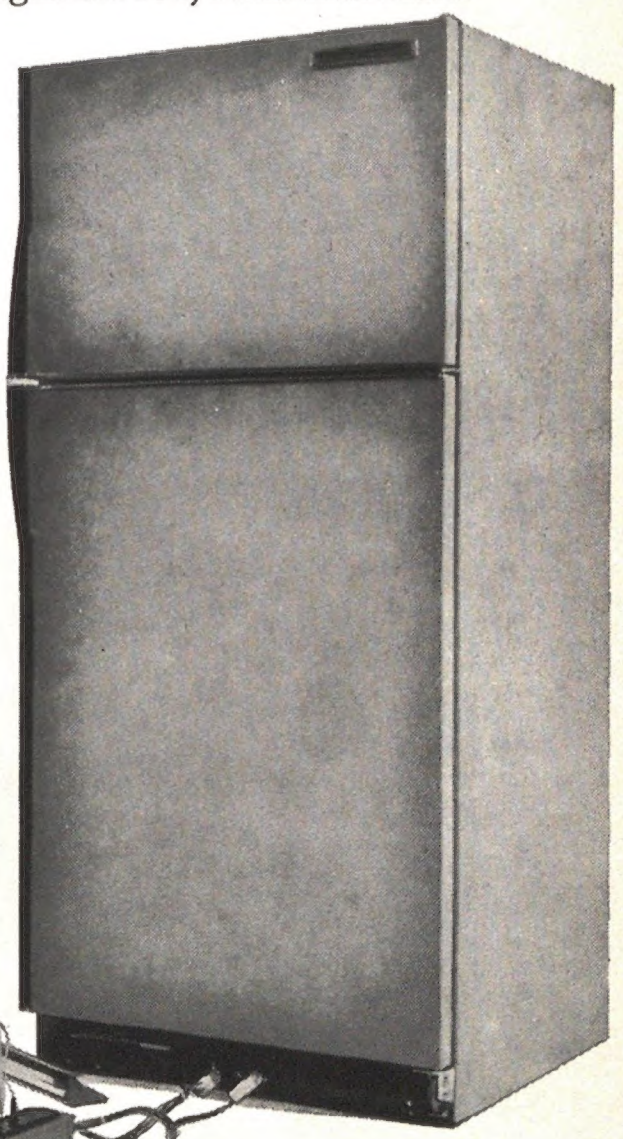

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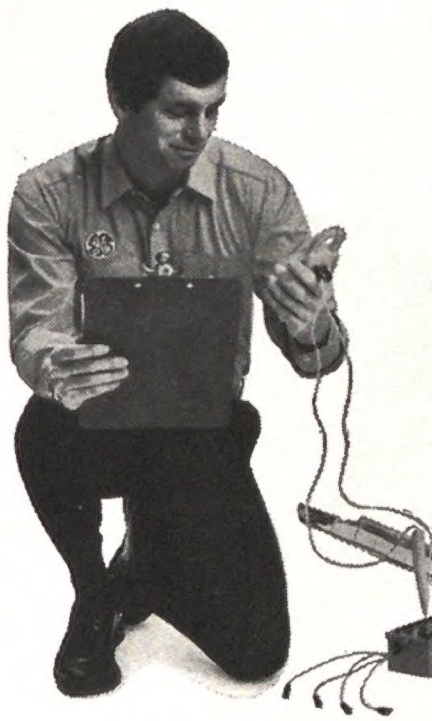

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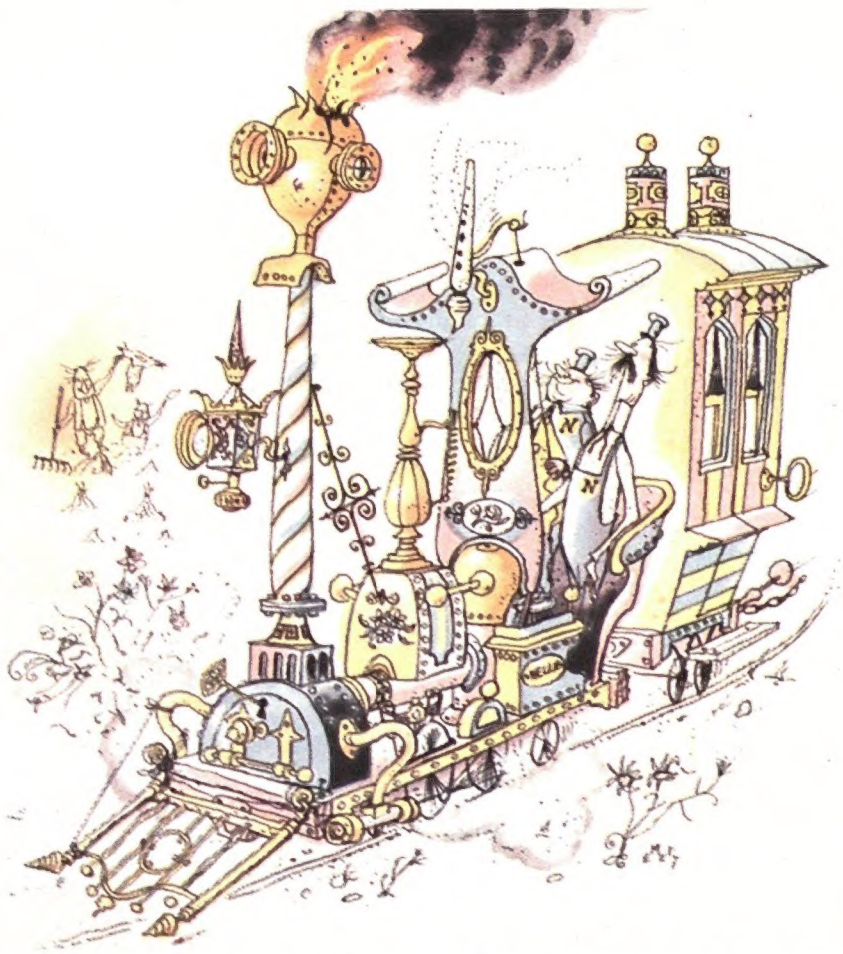
Letters to the Editor

Rowland Emett's machines

Dear Sir: Having long been a fan of Rowland Emett's amazingly intricate and fanciful cartoons, I was particularly happy to see some of them being translated into "real" life (July SMITHSONIAN).

Even though it was not mentioned in the article, I feel some attention should be paid to one of Emett's early works, a book called *New World for Nellie*. It was given to me as a child, and I recall spending many wondrous moments with it. I hope he will re-create Nellie, an old steam locomotive [see below], in his new park.

Joseph R. Marshall
Newport News, Virginia



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State flags

Dear Sir: I for one have not the slightest difficulty, despite Walter Angst, recognizing my native (Kentucky) flag or my adopted (Illinois) flag, and last year I watched dozens of children happily picking out their state flags in front of your Museum of History and Technology.
Mrs. Mary M. Boyles
Oak Park, Illinois

Dear Sir: The flag of California is one of the easiest to recognize and is very significant to California's history.

In June of 1846, without knowing that war had been declared, a band of American settlers, led by frontiersman Ezekiel Merritt, attacked a Mexican fort at Sonoma. After capturing the fort, the settlers unfurled a homemade flag bearing a single star, a grizzly bear, and the words, CALIFORNIA REPUBLIC. The words were *not* put on the flag for identification purposes as Mr. Angst states.

Also, the bear is not a "zoo" type at all, but a California grizzly bear shown as it would have been seen meandering across a meadow at that time.
Tom MacLean
Monte Sereno, California
In author Angst's opinion: "Any word put on a flag, at any time, is, by definition, for identification. The bear itself stands for 'California Republic.' This animal might be intended to be a grizzly (Ursus horribilis), *but in most representations it comes out quite tame and unheraldic."* ED.

Dear Sir: Mr. Angst describes Montana's flag as "cluttered" and in need of a simpler and more spectacular treatment. In his improvement, however, the author unfortunately got Montana's goat by substituting a Eurasian ibex for the zoologically unique Rocky Mountain goat.
Lawrence Curtis
Zoo Director,
Oklahoma City Zoo, Oklahoma

Dear Sir: Mr. Angst's proposal of a red pine cone as the main charge on a redesigned flag for the State of Maine would probably go over "Down East" like a bucket of old lobster bait. In any event, he should know that the state flower is the white pine cone and tassel, *i.e.* the growth tip, a thing of exquisite beauty in the spring. In case he does not already

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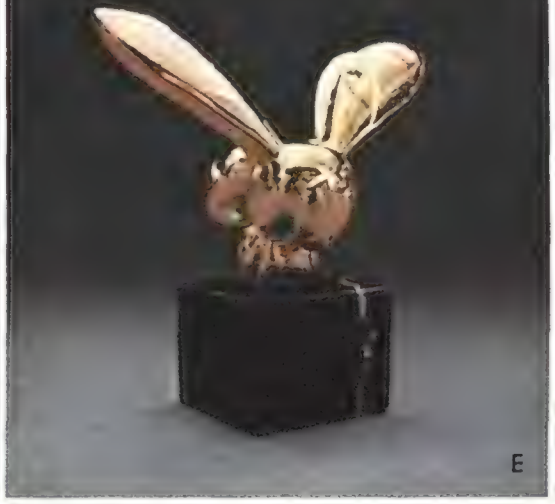
A

B

C

D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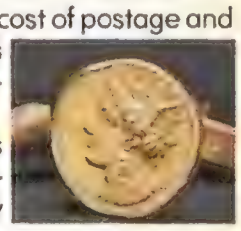

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I understand that approximately every six weeks (9 times a year) I will receive free the Seven Arts News which fully describes the latest main selection and alternates and scores of selections previously offered. If I wish the main selection, I do nothing. It will come to me automatically. If I want an alternate—or no selection at all—I will so notify you with the reply card which accompanies my News. I will have 10 days to let you know, and the deadline will be on the reply form. If I do not have 10 days to respond and therefore receive an unwanted selection, I may return it at your expense.

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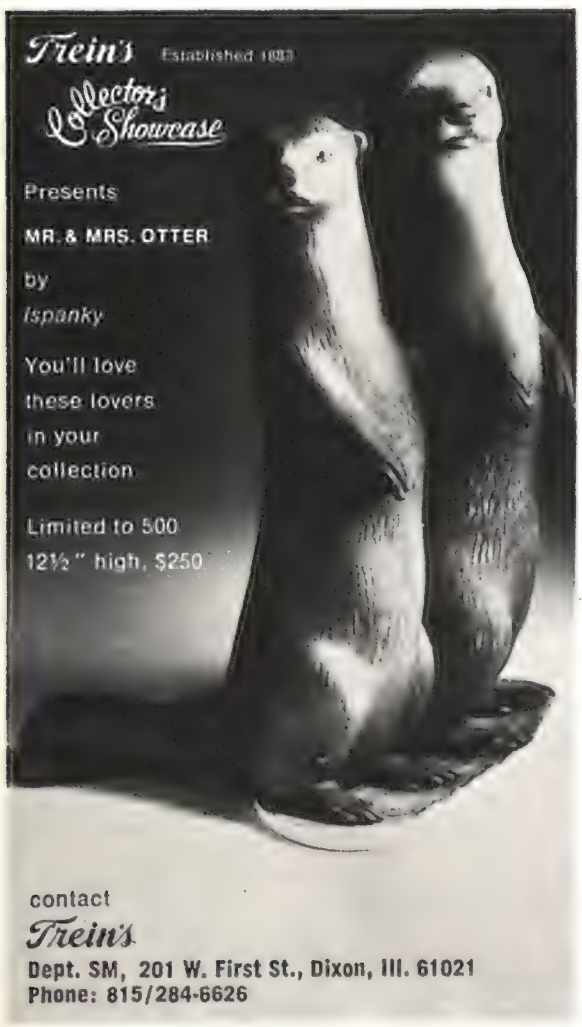

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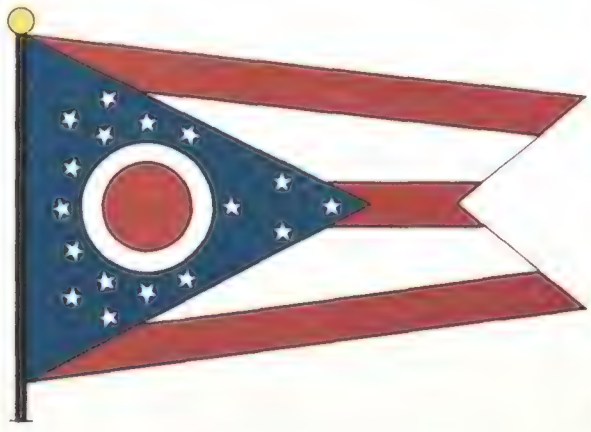
have a personal blazon, may I suggest one: *Azure, a string of worry beads, Or.*
John F. Battick
University of Maine
Orono, Maine

Dear Sir: The designs which the author presents are not pleasing to my eye. Perhaps a return to European medieval heraldry is not one of America's needs.
J.C. Raulston
Texas A&M University
College Station, Texas

Dear Sir: Walter Angst made an error in referring to 50 state flags. Ohio has a pennon [below] rather than a flag.
Gawain Jacobowicz
Cleveland, Ohio



Dear Sir: Has Mr. Walter Angst ever seen Vermont cows? Their mien is gentle, certainly not aggressively grotesque. Gentle cows give good milk, Mr. Angst, not bulls with *caboshed* heads.
Mrs. Hester B. Skehan
Randolph, Vermont

Dear Sir: Your article on redesigning state flags referred to the arms of the "town" of Limburg in the Netherlands. It is a province, not a town.
The Reverend James H. Van der Veldt
St. Matthew's Cathedral
Washington, D.C.
Father Van der Veldt is correct. Ed.

Dear Sir: My credentials are those of a professional vexillologist.

What Walter Angst's heraldic plan ignores is the need for a sound historical basis in every great flag design. Heraldry does not provide a universal absolute. Can we say that it is any more than his personal preference that the flag emblems be shown as large as the field will allow?

Even if we could assume that the rules of heraldry were consistent and clear (which they are not), this would not mean that they were meaningful for contemporary America. The good heraldic design of Maryland indeed is acceptable not because it is heraldic, but despite it. To use this type of heraldry for banners intended to be flown in Montana and Nevada is ludicrous.

Finally, Mr. Angst fails to give due credit to some very beautiful state flags flying today.
Whitney Smith
The Flag Research Center
Winchester, Massachusetts

Dear Sir: For the Bicentennial, we are planning an exhibition of existing and historic American flags of design significance, such as those singled out in your article for Maryland, Colorado, Hawaii and others. We will also do a number of colonial flags. Our principal project will be a series of competitive exhibitions for new flag designs. We hope to give the artist and the designer a better chance than they have had in the case of state and city flags. We will entertain artists' designs for any state, county, city, college or other non-profit cultural or charitable group, and notify the proper agencies of the existence of the designs.
Paul C. Mills
Director, Santa Barbara Museum of Art
Santa Barbara, California

Personal Rapid Transit

Dear Sir: In Daniel Jack Chasan's article, he states that "PRT may be an idea whose time is about to come." This, hopefully, is true, but heaven help us if it comes in the form illustrated in the article. Building a vast web of sky spaghetti is no way to help improve our urban environment. The only sane place for a PRT is underground with all the rest of the better-behaved public utilities.
James M. Howell
Architects & Urban Planners
Portland, Oregon

Dear Sir: As the resident of a town that has been blighted for 73 years by an overhead rapid transit system, I feel I must point out that three out of four of the pictures of PRT were taken from above the level of the structure, while the fourth, photographed from below, was taken at night. Therefore, you have not shown the greatest problem of an over-

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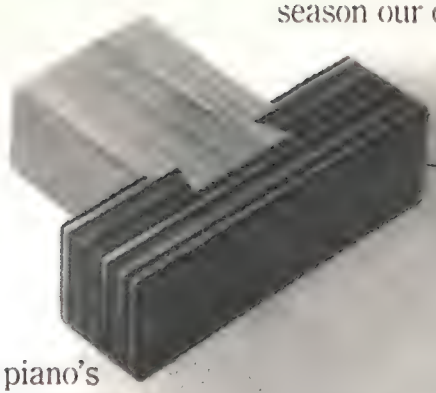

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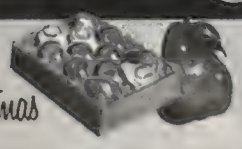

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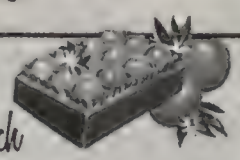

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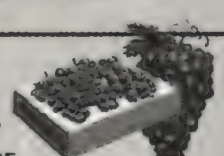

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Big, velvety-black Belgian hothouse type. Used to grow only for Royalty.
Net weight 4½ lbs.

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head structure—the unattractive, stained, glass-strewn and graffiti-ridden space below, which soon becomes the hotbed of blight capable of spreading for blocks and blocks.

We here in Charlestown strongly feel that it has depreciated our town and can only be considered an example of Painfully Regrettable Technocracy (PRT).
Erik Rhoades Anderson
Charlestown, Massachusetts.

The sad state of revolutions

Dear Sir: Patrick Ryan's "The sad state of revolutions" was light and amusing until he came to the last paragraph. He seems to fear that Women's Lib will label the Declaration of Independence a male chauvinist trick. His ideas are not new, nor are his fears groundless.

Abigail Adams, in 1777, protested to her husband John, one of the drafters of the document, that women were being ignored and she threatened that "we are determined to form a rebellion, and will not hold ourselves bound by any laws in which we have no voice or representation." I agree with Abigail.
Carol Farrar Kaplan
Nashville, Tennessee

Mysteries of ESP

Dear Sir: In my professional opinion absolutely no evidence exists that anyone has "psychic" powers as discussed in your article, "Science ponders the ESP mystery." But at least one reader will discover that he has ESP after correctly guessing the flip of a coin 67 out of 100 times.
Dr. Anthony F. Fazio
Associate Professor of Psychology
University of Wisconsin
Milwaukee, Wisconsin

A preservationist

Dear Sir: Les Line stated in his article that when our bank bought the Sparta village green, "the old bank" and "some swampy lowland at the outskirts of town" were part of the deal. Actually the bank paid $6,500 for the lot in a cash transaction that included no trade of land. Five years later the old People's State Bank was sold to the village.
Ivar F. Johnson, President
Sparta State Bank
Sparta, Michigan

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Phenomena, comment and notes

A project for bamboo lovers, women and still waters, man-made aurora and a replacement for the coffee break

Most office workers are all too familiar with the feelings of drowsiness, fatigue and discomfort that often arrive in the afternoon accompanied by a decline in mental and physical efficiency. There are plenty of explanations, ranging from too big a lunch to laziness to an ill-timed biological clock to the simple desire for a coffee break. But it may not be coffee that the irritable worker needs; he may require a shot of negative ions.

Negative ions are molecules that have extra electrons; positive ions have missing electrons. Normal clean air over land is loaded with ions—up to 4,000 per cubic centimeter, according to Dr. Albert Krueger, a bacteriologist at the University of California (Berkeley), who wrote of these matters in *New Scientist*.

On the other hand, polluted air, air-conditioned air, city buildings, offices and factories have been found to be deficient in ions, particularly negative ones.

Experiments indicate that plants grow better and mouse sex is more vigorous in an ion-rich atmosphere. Further, it is known that an increase in the ratio of negative ions to positive ions facilitates learning in rats.

The Sharav, an ill wind in the Near East that legendarily brings on depressions, sleeplessness and a variety of other human discomforts, including nausea, has now been found to be preceded by a drastic drop in the air's negative ion ratio. Treated to negative ion-rich air, those afflicted by the Sharav syndrome will quickly return to their normal selves.

Apparently, among other physiological effects, negative ions tend to reduce the level of a hormone called serotonin in the brain and this reduction has a tranquilizing effect. Extrapolating from experiments with mice, Dr. Krueger suggests that a negative ion-enriched atmosphere would not only make the polluted, air-conditioned city dweller less irritable and lethargic, but it might well confer on him a greater resistance to influenza and other infections.

So please pass the ions.

Man-made aurora

Given Dr. Krueger's findings about ions and temperament, one must at least hesitatingly applaud the announcement that Russian space scientists have induced an artificial aurora in the ionosphere. Borne by a controlled weather rocket, a device like a gun pumped electrons along the lines of force of the earth's magnetic field, presumably creating a lot of negative ions. This effort, which will be followed soon by a similar joint Russian-French venture, was a purely geophysical inquiry, but who knows what kind of fallout there might be from such ventures?

Still waters and women

The surface of still water (in a bottle, say) remains horizontal when the bottle is tipped: Everyone knows that. Well, not everyone. Three psychologists from Pennsylvania State University report in *Science* that boys understand this principle, most by age 12. "Girls, however, lag behind boys at all ages in this respect, and about 50 percent of college women still do not know this principle."

Perhaps, you might say, that is because girls, brought up in a male chauvinist society, are discouraged from being interested in what happens to the surface of water, just as they are discouraged from playing with trucks, but that seems not to be the case. The three psychologists gave "tasks designed to optimize self-discovery of this concept" to about 50 women who didn't already know it. Only seven figured it out.

The psychologists, one of them a woman, expressed some distress that they had no way of satisfactorily explaining this flaw.

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The problem with bamboo

Throughout the 1960s the stands of Japan's giant timber bamboo, or *Ma-dake,* began to die as if struck by some inexorable plague. By 1969 as much as half of the total crop had died, an economic disaster that was not only predictable but altogether unavoidable (see SMITHSONIAN, May 1970). Although it is not a commercial plant in the United States, the same thing has been happening here for four years, according to the Center for Short-lived Phenomena.

Ma-dake was brought to the U.S. in the form of shoots in the mid-19th century and has been cultivated as an ornamental plant ever since. The plant contains a kind of genetic alarm clock: every 60 or 120 years it comes into flower and then dies. When the bell tolls for the original stand, it tolls also for any shoot-propagated descendant no matter where in the world it is growing. Stands have flowered and died in Georgia, Louisiana, California and Washington, D.C.

When the plant flowers, it loses most of its usual leaves and clusters of small green leaves form at the end of the branches. Within these clusters, or bracts, one can find the totally unspectacular, petalless flowers (see photograph). After flowering, the culms (stems) die down and it will be 15 years before new shoots from the horizontal underground stems have replaced the bamboo stand.

Though unspectacular in a floral sense, this phenomenon is for a botanist what the return of Halley's comet is for the astronomer: The only chance of a lifetime. And so Drs. Thomas R. Soderstrom and Cleofé E. Calderón of the Smithsonian Institution's Department of Botany have sent out an appeal for samples of flowering *Ma-dake* as part of the first comprehensive study of the plant in the United States.

Smithsonian Associates are encouraged to take part. If *Ma-dake* flowers in your vicinity before the first of the year (the cutoff date for the study), ask the owner if you can snip off a flowering branchlet about 4 or 5 inches long. Dry it for a few days between newspapers weighted down with books and then tape the specimen to the back of a piece of paper or card-

Pressed sample of *Ma-dake* bamboo showing the fatal flowering stage.

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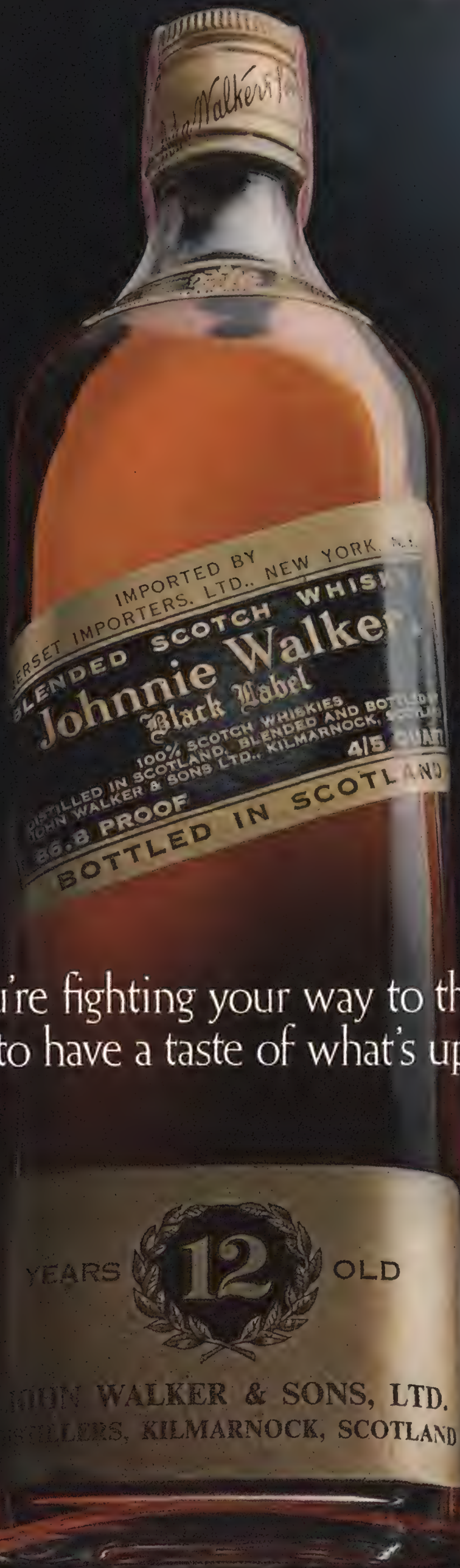

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Close, but no mosquito

A Cuban, Carlos Finlay, is credited with suggesting in 1881 that yellow fever was transmitted by the mosquito, *Aëdes aegypti*. Proof came 19 years later and yellow fever was on the way to being controlled. It now seems that the mosquito connection came within a hair of being discovered almost 100 years earlier.

One of the worst of many outbreaks of yellow fever that struck Philadelphia from the time of its founding occurred in 1793. It was blamed on "a putrid miasmata" by Dr. Benjamin Rush, the city's leading physician, according to *Life and Times in Colonial Philadelphia* by Joseph J. Kelley jr. Along with bleeding the victims, health measures included throwing garbage out in the streets where dogs could eat it. It was also suggested that bonfires be lit to purify the air.

Just as the death toll climbed into the hundreds, a man whom historian Kelley does not name wrote a letter to the Philadelphia *Advertiser:*

"As the late rains will produce a great increase of mosquitoes . . . it will be agreeable to the citizens to know that the increase of those poisonous insects may be diminished by a very simple and cheap mode." After advising the citizens to examine their rainwater tubs for signs of larvae, he suggested that they "take up a wine glass full of water, and it will exhibit them very distinctly. Into this glass pour half a teaspoonful or less, of any common oil, which will quickly diffuse over the surface, and by excluding the air, will destroy the whole brood. . . ."

And later on, in a severe recurrence of the fever in 1797, writes Kelley, Dr. Rush himself "even commented on the large number of mosquitoes without realizing the role they played in the epidemics."

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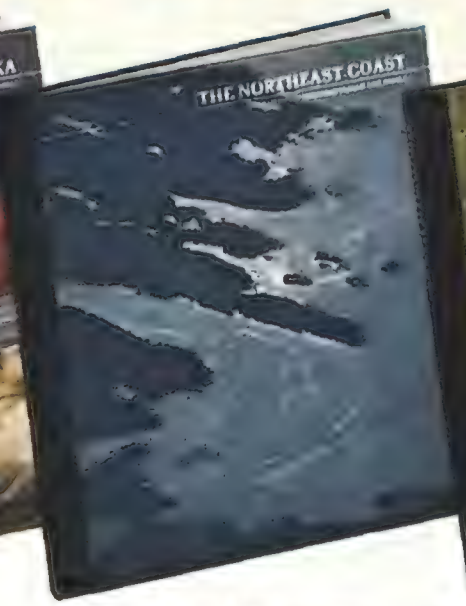

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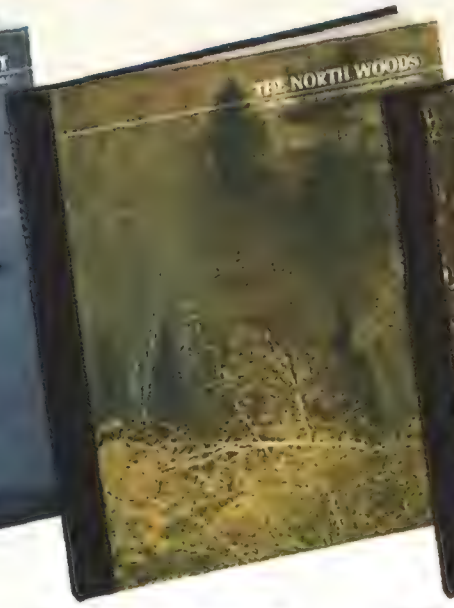

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By Rudolph Chelminski

China unveils a breathtaking show of its archaeological treasures

Objects excavated since 1950, never before seen in the West, show that the People's Republic cherishes its artistic inheritance

The art sensation of Paris has been a dazzling exhibition of archaeological treasures from the People's Republic of China. After drawing massive crowds to the Musée du Petit Palais for more than three months, it will unquestionably do the same in London this fall and in the United States when it comes here next year. In fact, there has been nothing like it since the British Museum's exhibition of Tutankhamun's treasures (SMITHSONIAN, June 1972).

What makes the show so remarkable is not only the high quality of the objects in it, but the fact that they were all discovered within the last 22 years, or since the Communists came to power. They are the fruits of a diligent and extensive archaeological program, undertaken both for scientific purposes and to replace collections that had been taken to Taiwan by the departing Nationalist forces. They will also serve to reassure those Sinophiles who had feared the worst because of the excesses of the Cultural Revolution. Regardless of revoluntionary enthusiasm, China under Mao respects her artistic patrimony.

"Treasures of Chinese Art" is thus both an exposition and a demonstration of national purpose. It is one of those rare occasions when an artistic event is clearly as important scientifically as it is esthetically.

"This is the first time in history," said Vadime Elisseeff, the distinguished French orientalist who was largely responsible for putting the show together in conjunction with the Chinese authorities (and to whom I owe most of the material for this article) "that such a set of pieces from archaeological digs—dated and localized—has ever been brought together."

In the past there have been shows of equal or even greater ambition, notably in London in 1935 and in Venice in 1954, but both of them were seriously flawed in Elisseeff's opinion.

"Very few of the pieces in those shows had pedigrees," he said, "and those that did were basically traditional, by word of mouth: An antique dealer got something from another dealer, who got it from a 'fence,' who had got it from a peasant on the site."

The current show is an anthology of the best recent discoveries, a panorama of Chinese art from Paleolithic man to the 14th century. If the show starts slowly with an understandably sparse harvest of Paleolithic remains (part of a skull, a few rough stone instruments), it nevertheless establishes the existence of a previously unknown anthropoid, now called Lan-t'ien Man, whose life on the banks of the Yellow River antedated the classic northern-dwelling Peking Man (500,000 B.C.) by some 100,000 years.

With the Neolithic age the show immediately finds its style and excitement. Already artistic currents and the interaction of cultures can be established. At the same time, some hoary historical theorizing is brushed aside. In 1921 the Swedish archaeologist Gunnar Andersson discovered vestiges of ceramic and painted pottery on the Yellow River in Kansu province, at the very edge of Chinese Central Asia, which he thought showed the influence of other painted pottery cultures to the west, notably in Iran and Chinese Turkestan.

This porcelain wine jug from the Sung dynasty (960-1279) has a lotus-shaped bowl for keeping the wine warm. It was found in a tomb dated 1087.

Photographs by Dmitri Kessel

The sophistication achieved by Neolithic Chinese cultures, which date from about 4000 B.C., is evident in this painted pottery cup from Kiangsu.

In this Shang dynasty (16th-11th century B.C.) cooker, legs were filled with water and set in fire; food was steamed in perforated top section.

There had been no plausible reason to doubt his theory until the discovery in 1954 of what appears to be the much older Neolithic village of Pan-p'o, near Sian in central China. Pan-p'o (which may be dated between the third and fourth millenniums B.C.) not only offers ample proof of the "Neolithic Revolution" (villages, the development of agriculture, the domestication of animals) but, further, its pottery reflects the same motifs discovered by Andersson in Kansu—and apparently antedates it. The conclusion of Chinese archaeologists is that, far from submitting to Western influences, the culture represented at Pan-p'o was self-generating and radiated outwards, eventually spreading westward to Kansu and elsewhere.

The passage from Neolithic to Bronze, the true beginning of Chinese history, was marked by the five-century (tentatively 1600 B.C. to 1100 B.C.) rule of the Shang dynasty. First proof that this hitherto legendary dynasty did indeed exist was brought to light in 1928 by the discovery of the celebrated "Yin-hsü," a capital city of the later Shang kings in the neighborhood of An-yang. Some of the magnificant bronzes found there have been dated as far back as the 14th century B.C. Since then, impressively extensive research by Chinese archaeologists has moved back the birth of sophisticated bronze techniques by a couple of centuries.

The Chinese now characterize this period as the "slave society" because of the bodies of hundreds of servants found in Shang tombs, murdered to accompany their masters to the beyond. Cruel and sanguinary though they may have been, the Shang saw China into authentic civilization, with a written language, urbanization, a highly developed agriculture and work specialization fostered in ateliers—all guided by a central authority. The Chinese state was born.

The Shang were swept aside by the vigorous, military hand of the Chou kingdom during the 12th century B.C. Disciplined and Spartan, the Chou gave China a system of administration which remained virtually unchanged until the time of Confucius (551-479 B.C.). After four centuries of rule, though, the Chou experienced the same weakening of purpose common to all military regimes in power for too long; the kingdom broke up into several principalities, each of which, of course, promptly began to covet the properties and goods of its neighbor. The resultant squabbling has become known as the "Spring and Autumn" period, from a book of that name which records some of its history (8th to 5th centuries B.C.).

By 475 B.C., ten states had emerged that were strong enough to hold themselves together. It was the beginning of the period of the Warring States, which is of multiple significance to the Marxist theoreticians of China today. In their view it marks the end of the slave society, the start of feudalism (even though it was foreshadowed among the Chou) and the dawning of the Iron Age—three giant steps of historical evolution, all nicely presented at the same time. Whereas the Shang had given China bronze and the early Chou

Rudolph Chelminski, a former Life *correspondent in Paris and Moscow, now free-lances in Europe. Mr. Kessel photographed recent finds at Thera and Pompeii for* SMITHSONIAN *(January and October 1972).*

Bronze wine vase, buried during barbarian raids in 771 B.C., is inscribed: "Precious ritual vase dedicated to Je Ki. May his son and grandson make eternal and precious use of it for 10,000 years."

Pair of bronze leopards encrusted with gold and silver was found in tomb of the Early Han princess

Silver-encrusted bronze ritual vase in animal form is from Early Han dynasty, 206 B.C.-A.D. 8.

had given it organization, the Warring States saw the birth of the great schools of thought, one of which was dominated by the mind of Confucius. Social structures altered as cities were walled and fortified. Cast iron became commonplace, a thousand years before it would in the West. Ironically, the ability to produce the high temperatures needed for casting iron held up the discovery of the lower-temperature technique of forging iron; in China the foundry preceded the smithy, the exact opposite of the Western experience. Nevertheless, agriculture immediately benefited from the new cast-iron tools, with larger crops contributing to growing prosperity.

The period of the Warring States was ended singlehandedly by the extraordinarily dynamic king of Ch'in, who took over the various small states and by 221 B.C. had them all under his control. He had himself proclaimed Shih Huang Ti, the first emperor. Although his reign lasted barely ten years, Shih Huang Ti left a considerable mark on history. It was he who completed the Great Wall by joining up segments that had been erected earlier and who led campaigns north and south to bring vast new territories into his empire. Internally, he broke the old powers of the nobility, standardized writing and weights and measures, marked out roads and even instituted passports. His death, naturally, was the occasion for construction of a grandiose tomb which, according to ancient writings, was so sumptuous that it held treasures without limit and "rivers of mercury" to represent the celestial courses. But the tomb was pillaged heavily and nothing this grand has yet come to light, in spite of intensive recent digs.

With the Han (206 B.C.-A.D. 8; A.D. 25-220) we come to the two unquestionable stars of the show, around which the crowds inevitably gather—the "flying horse" (p. 33) and the jade burial suit (pp. 34-35). The Han

Tou Wan (second century B.C.), along with the remarkable jade burial suit shown on pages 34-35.

Bronze vase encrusted with gold and silver is from the tomb of Prince Liu Sheng, Tou Wan's husband.

represented an unequalled apogee of Chinese power and civilization and it is indelibly reflected in their art. It was in 1968 that teams digging in the area of Man-ch'eng in Hopei province uncovered the tombs of Prince Liu Sheng and his princess, Tou Wan. Among the 2,800 objects brought to the surface were two virtually intact jade suits sewn with gold thread, the first ever found so complete. Archaeologists had known of the existence of such suits, but only bits and pieces had emerged in other digs. More commonly found had been the simple "orifice obturators," the individual pieces of jade placed over the human body's orifices in a hopeful attempt to prevent any one of the several souls from fleeing through them. Obviously, though, this simple sort of burial plan would not do for a person of imperial rank: Liu Sheng and Tou Wan were encased from head to foot entirely in jade—to prevent the bodies from putrefying as well as imprisoning the souls. Jade was thought to be supreme against all manner of corruption.

Unicornlike animal, in carved and painted wood, comes from the Later Han period, A.D. 24-220.

Early Han bronze shows a boar attacked by tigers, while a snake (left) bites the tail of one of them.

Braying camel and its driver date from beginning of the eighth century A.D., a high point of T'ang art.

In this case the jade endured beautifully, but after 20 centuries, all that remained of the unfortunate princess was a single tooth. Her suit (the prince's suit is not on display in the show) is composed of 2,156 individually shaped plaques of jade, painstakingly assembled like a puzzle and sewn together with pure gold thread through tiny holes bored in each of the four corners.

One of the peripheral civilizations of the Han empire is represented by the objects discovered between 1955 and 1960 at Shih Chai Shan in Yünnan province, an area incorporated into the Tien Kingdom. This "provincial" art, including the decorative plaque of a boar being attacked by tigers (p. 30), shows unmistakable signs of direct influence by steppe civilizations—links to the West not known further north.

The flying horse is an unrivalled demonstration of the grace and seeming simplicity of which Han artisans were capable. It was discovered in 1969 at Lei-t'ai, in the district of Kansu, in the tomb of an obviously important general. Among the objects keeping company with this illustrious personage was a troop of cavalry in bronze, consisting of 39 horses, 14 chariots, 17 horsemen and 20 servants, all of them disposed in proper military order. Dominating all of it, though, is the single, riderless flying horse, whose proud pacing attitude is rendered even more buoyant by the single hoof that bears its weight—and under which is a swallow on the wing!

The barbarians arrive

Despite their prosperity, or perhaps because of it, the Han empire in the north weakened and began to crumble under the onslaught of the northern barbarians. In the south, which continued under legitimate Chinese rule, the period separating the Han from the Sui (from A.D. 220 to 581) was known in part as the Six Dynasties. It was during this time the first examples of celadon—that hard, greenish ware which has some of the properties of jade—appeared. The ovens at the potters' disposal were capable of temperatures as high as 1,000 degrees centigrade, an exploit utterly unknown in the West at the time.

The short (37 years) Sui dynasty brought reunification of the empire, centralization and a reinstallation of order. Addicted to music, they founded several schools and recorded in ceramics and terra cottas their love for the art.

Both terra cotta and a form of translucent porcelain rose to new heights of sophistication under the T'ang, successors to the Sui. "Three Color" glazed terra cotta was achieved, a sumptuous mixture of creamy white, green and light yellow. The most striking examples in the show are the two funerary statuettes of horses, one grazing and one whinnying (p. 32), found in the tomb of Princess Yung-t'ai between 1960 and 1962. Her resting place, an elaborate sepulcher in Ch'ien Hsien (Shensi province), is particularly interesting as a reference to the imperial tastes of the T'ang. Because of her royal station, the funerary objects she merited were obviously of the best quality of the period. Even the statuettes, though, pale in comparison with the tomb itself, a mammoth public works undertaking

Whinnying horse in Three Color glazed terra cotta is a funerary figure from the tomb of a T'ang princess who was executed in A.D. 701 and reburied, in the grandest style possible, five years later.

Magnificent bronze "flying" horse (evidently a pacer) was found in the tomb of a later Han general.

Chariot with parasol came from the same tomb, part of a whole troop of miniature bronze cavalry.

Animated figurine from Yüan dynasty (1276-1368) depicts whistling actor with fingers in mouth.

some 40 feet underground, reached by a sloping ramp.

If Princess Yung-t'ai's tomb demonstrates T'ang ceremonial funerary art at its finest, the Cache of Ho-chia does the same for the day-to-day treasures of a person of royal blood. Discovered in 1970, the cache was inside two large terra-cotta jars buried under what had been the home of a certain Prince Pin, a cousin of the emperor, just south of the present city of Sian. It was in A.D. 756 that the prince was obliged to flee when an insurgent general attacked the capital. Evidently the only one who knew the location of his cache, the prince died before he could return to claim it. The Chinese archaeologists who finally came across it inventoried more than 1,000 objects from the two jars—silver and gold vessels, jade, precious stones and even products used in pharmaceutics. The cache is the richest single collection of T'ang treasures ever discovered.

With the Sung (960-1279) the invading barbarians became more and more a harsh fact of life in China, but cultural forces were by no means atrophied or even slowed. The artisan was respected as never before, and he responded by turning out celadons of a purity and perfection not achieved even by the T'ang. It was during this time, too, that true porcelain was perfected.

The Sung were in a seemingly perpetual rearguard action with the barbarians. Between 916 and 1125 a Manchurian tribe occupied all the territory north of

Princess Tou Wan's extraordinary shroud consists of 2,156 pieces of jade, sewn at the corners

the Great Wall; they in turn were succeeded by another tribe, who spread their rule farther south. Then in 1206 a Mongol chief proclaimed himself Supreme Khan—Genghis Khan—and it was his grandson Kublai Khan who conquered China in its entirety. In spite of the invaders' notorious sternness and cruelty, though, the arts flourished as did the economy. The first blue-and-white porcelains, so famous under the later Ming, appeared during the period of the Yüan (1276-1368). The optimistically comical terra-cotta actors (opposite and right) prove that not even the Mongols could smother the natural Chinese penchant for mirth.

The exhibition ends with the Yüan in the mid-14th century, rather than continuing on to the Ming and later dynasties. Whatever the rationale, it makes a sensible cut-off point. This is an archaeological show, not a survey of the whole of Chinese art; the objects on display were all found in caves, recovered from tombs or excavated from the earth. From the time of the Ming (1368) onward, such objects tended to be kept in palaces and handed on from generation to generation. They have thus been much more visible.

These rare objects from the earlier centuries, whether a Neolithic painted pottery bowl or Princess Tou Wan's jade burial suit (below), can only serve to remind Westerners of the immense age, splendor and refinement of Chinese civilization.

Dancing actor, like statuette opposite, reflects strong interest in the theater under Yüan.

with gold thread. Experts estimate that it would take ten years of a Han artisan's time to make.

By Howard Ensign Evans

Taxonomists' curiosity may help save the world

Many say there's neither time nor need to try cataloguing all the world's creatures. A scientist says it is necessary that we try

It was in the autumn of 1728 that a young medical student with a passion for botany and a young divinity student with a passion for fishes met at the University of Uppsala—and the spark that leapt between them was to ignite a flame that is still burning. This was the age of enlightenment, the era of exploration—a time when the study of natural history had become respectable, and when expeditions to distant parts of the globe were reporting plants and animals previously undreamed of. What could be more important than to inventory all of the things of nature? But seven years later Peter Artedi, the divinity student, stumbled into a canal and was drowned, and it remained for Carl Linnaeus to bring their plans to fruition.

This he did with great success. His *Systema Naturae* went through 13 editions, each one something of a scientific best seller for its day. Furthermore, he set in motion what is often called "the Linnaean age," a long period when nothing seemed more worthwhile than to describe and classify species. Taxonomy—the science of classification—was a calling of the highest repute.

In retrospect, Linnaeus' system of naming organisms hardly seems revolutionary. Giving things double names—one a group (generic) name and the other specific—is as natural as speech itself. For example: red maple, grizzly bear, honeybee. Linnaeus used Latin, the scholarly language of his day, and very logically put the group names first: hence *Acer rubrum, Ursus*

Illustrations by Fred Gwynne

horribilis and *Apis mellifera.* It is true that Latin is no longer part of the education of most of us, but if Linnaeus had used his native Swedish, his system of names would hardly have become universal. And, as a dead language, Latin has no political connotations; to a Russian or a Japanese or anyone else, *Acer rubrum* is still *Acer rubrum.*

Such names can roll off the tongue like a song. I well remember how, as a college freshman, I delighted in surprising my friends with the name of the green sea urchin, *Strongylocentrotus dröbachiensis.* What a wonderful name, enough to give a computer indigestion! But let's not let automation squeeze *all* the poetry out of life. And the cold fact is that those who find Linnaean nomenclature cumbersome have yet to propose a successful alternative. To a considerable extent, we are still in the Linnaean age, for we still use his system of binomial nomenclature; and taxonomists, by and large, are still committed to the belief that a complete systematic inventory of living things is not only possible but a matter of high priority. Nevertheless, both Linnaean nomenclature and the hope and need for a total inventory of nature are now being seriously questioned.

Linnaeus in his *Species Plantarum* (1753) recorded about 7,300 species of plants, and in the tenth edition of *Systema Naturae* (1758) some 4,200 species of animals. But today the number of described species of flowering plants exceeds 300,000, and slightly more than a million kinds of animals are known. Many Linnaean genera are now regarded as families, and a host of new categories have been devised to accommodate all of these names. Classification has become so complex that textbooks can present only the barest outline (and hardly any two agree). The detailed classification of specific groups is often known to but a handful of people scattered widely about the globe—and they are unlikely to agree on all particulars.

In a recent article in *Science,* Peter H. Raven, Brent Berlin and Dennis E. Breedlove stated that there are approximately ten million kinds of organisms, and despite more than two centuries of effort we have still described only some 15 percent of them. Furthermore, "the rapid growth of the human population will cause most of the remainder to disappear from the earth before they are seen by a taxonomist." So much for the dreams of Linnaeus and Artedi.

"The complete description of life on earth . . . is impossible," wrote Paul Ehrlich of Stanford University almost ten years ago. And, more recently, Ernst Mayr of Harvard, one of the most widely respected figures in the field of systematics, expressed his opinion that "we need work in alpha taxonomy [that is, species] only in the areas where such knowledge is essential." Unfortunately, he provides no rigid standards for deciding what is essential, and I suspect that the average

In this visual fable, which was inspired by (and starts sequentially below) Dr. Evans' reasoned plea for more taxonomic research, a multitude of fantastic animals stream across the scene, yet . . .

businessman, congressman or (for that matter) college administrator would, on this basis, sweep all of taxonomy into the wastebasket.

I doubt that scientific progress has ever resulted from pursuit of the "essential." Rather, it has emanated from persons who were, above all, *curious*. And to accept any of the dicta quoted above is to say that to be curious about the diversity of nature is to be misguided. As R. J. Herrnstein of Harvard University has pointed out, "what looks 'important' at any time reflects a consensus based upon what is already known." If this is true (as it surely is), one could make a strong case for the deliberate pursuit of what seems unimportant and nonessential (as I would).

A year or two ago I became interested in an obscure group of South American spider wasps of unknown relationships. I was puzzled because no females had ever been discovered, although males of several species were not uncommon in the collections of several museums. All of these males were banded with yellow and brown like many of the social wasps of the tropics, which are abundant and armed with powerful stings. After careful study of museum material and discussions with persons who had collected these wasps in the field, I concluded that the females must have been placed in a different genus because, in overall form and in coloration, they were utterly unlike the males. All had, in fact, blue-black bodies and orange wings, and were evidently mimics of tarantula hawks and other widespread wasps of similar color.

This proved to be the first known case of what I called dual mimicry; that is, a case in which the females and males of the same species belonged to very different mimicry complexes. It happens that in these wasps the two sexes spend most of their time in different habitats. Under these conditions it evidently had survival value (vis-à-vis vertebrate predators) for each sex to adopt a color pattern like the most pernicious stinger in its habitat. Having drawn these conclusions, I re-examined several other puzzling groups and found several additional examples.

Now I would be the last to claim that this research was essential, but it was gratifying; it fitted a few "loose pieces" into place and it resulted in a hypothesis of at least limited application. By some standards, no doubt I should have junked my manuscript. Recycled, the paper might have provided the wrapper for a package of spaghetti or some other essential commodity. As it is, I have added to the glutting of our libraries simply to satisfy idle curiosity. But I wonder whether most of what we do now know about our en-

Dr. Evans, author of Life on a Little-Known Planet *and* Wasp Farm, *recently moved from Harvard's Museum of Comparative Zoology to Colorado State University. Mr. Gwynne is a stage and TV actor.*

. . . how less fantastic is the true range of diversity among creatures that really inherit the Earth.

vironment didn't come about in much the same way.

Fortunately, there are many people who still find living things so terribly exciting that they cannot leave them alone. We live on a planet where, through several billion years, vast numbers of distinctively different kinds of organisms have evolved from simple primordial molecules. The processes we can now deduce, though with some uncertainties, and the products we can study in nature and in the holdings of our museums. To thinking persons they provide a drama without parallel. We have spent billions of dollars to collect a few sterile rocks on the moon—and are still devoting endless pages in our journals to their analysis. Has the dead moon become more essential to us than the living Earth?

I agree that as human populations continue to expand, the delicately balanced environments of more and more living things will be destroyed; we see this happening every day. That is all the more reason to make an all-out effort to describe the diversity of life, for without such an effort we shall simply never know. And a case can be made for our greater dependence on the things of nature as the human population approaches saturation. The sperm whale is nearing extinction, but we read in SMITHSONIAN (April 1972) that an obscure desert plant called jojoba produces a liquid wax very similar in chemical properties to sperm oil. We hear that a little-known beetle produces cortexone, a medically important drug, in amounts equivalent to the adrenal glands of 1,300 cattle. How can we know what organisms may enrich our lives—or permit us to survive a bit longer—if we cease to inquire? How can we be sure that we are not, this year, bringing about the extinction of a species that we may desperately need 50 years hence?

At the moment much research is being conducted on prostaglandins, very potent hormones that occur in minute quantities in most animal tissues and exhibit a startling array of pharmacological properties. Among other things, they appear to mediate inflammation, and a better understanding of their precise role may some day lead to more effective treatment of such persistent maladies as asthma and arthritis. A few years ago it was found that compounds closely related to prostaglandins occur in quantity in a gorgonian (soft coral) inhabiting West Indian reefs. The very limited supply of mammalian prostaglandin is expected to be supplemented soon by large quantities obtained by synthesis from precursor compounds in the gorgonian. This is exciting news for researchers and for pharmaceutical companies, one of which is already planning to harvest the reefs—one hopes with appropriate caution and good sense.

Paul D. Hurd jr., chairman of the Entomology Department of the Smithsonian Institution, has been studying, along with several coworkers, the systematics

and host relationships of bees of the genus *Peponapis*. These bees collect pollen only from the blossoms of *Cucurbita*, a genus that includes our cultivated squashes and pumpkins, and there is evidence that the bees and their host plants evolved together in warmer parts of the Western hemisphere.

Not only has the systematics of the bees provided clues as to how cultivated squashes may have evolved from wild ancestors, but it appears that it may be possible to increase the yield of these crops in the Old World (where they were brought from America long ago, without the bees) by establishing species of *Peponapis* in suitable habitats. Hurd and a coworker have described about a third of the species of *Peponapis*, and it is quite possible that the groundwork they have laid may prove far more relevant in retrospect than it ever did at the time.

Examples such as this could be supplied ad infinitum. In 1885 Carlos Berg, in the course of his studies of the Argentinian insect fauna, described a small moth as *Cactoblastis cactorum*. Did he foresee that 40 years later 60 million acres of Australian countryside would be overrun by alien cacti and that of 150 cactus-feeding insects surveyed, *Cactoblastis* would prove the key to the problem—nearly wiping out the cactus in a few years? Of course he didn't.

Could anyone have predicted the current search for "wonder drugs" in diverse and often poorly studied parts of the plant world? The discovery in recent years of antibiotics, muscle relaxants, hypo- and hypertensive agents, cortisone precursors and a startling array of hallucinogens has led Richard E. Schultes of Harvard to remark that "the Plant Kingdom represents a virtually untapped reservoir of new chemical compounds, many extraordinarily biodynamic, some providing novel bases on which the synthetic chemist may build even more interesting structures." Professor Schultes cites an estimate that perhaps a fourth of the vascular plants of the New World tropics—a proven source of new drugs—have yet to be described, and many of the described species remain poorly known. Is it appropriate to throw up our hands in despair, when we can be quite sure that discoveries of many kinds await those who work toward them?

Every blueprint for survival on Earth includes the substitution of biological control methods for chemical pesticides. Why is this proving so difficult? Because the parasitic wasps and flies that we wish to rely upon are so poorly understood. These are very tiny insects, requiring detailed study of their structure, life histories and host relationships. A good friend of mine who has devoted many years to the study of ichneumon wasps, perhaps the largest of all groups of parasites of pest species, had his research funds cut off, doubtless by persons convinced that we can "no longer afford" to be curious.

The opinion that taxonomists should discriminate species only "where such knowledge is essential" is hardly novel. One of my favorite quotes to taxonomy classes is the following: "It seems to me sufficient to consider those kinds [of organisms] which prove to us that they deserve to be distinguished. . . . It seems to me that the many hundreds and hundreds of species of gnats and very small moths . . . may be left confounded with one another."

This is from the Introduction of Réaumur's *Mémoires pour servir à l'Histoire des Insectes,* published in 1734, one year before the appearance of the first edition of Linnaeus' *Systema Naturae.* Are we to return to pre-Linnaean times simply because the task proved far more difficult than supposed?

I would like to reconsider, too, the statement mentioned earlier that we have only described some 15 percent of the ten million kinds of organisms. It is commonly agreed that most species of birds have been described, and a high percentage of the species of mammals, butterflies and several other "popular" groups. In the group I know best, the Aculeata wasps, I would estimate that more than 90 percent of the species north of Mexico have been described (though admittedly the tropics do not fare so well).

Speaking of the insect fauna of Australia—one of the most inadequately studied groups from one of the less well known continents—K. H. L. Key estimates that the description and naming of species may be 70 percent completed (although I think this percentage is a bit too high). Flowering plants continue to be described at the rate of about 3,700 species a year, but here (as in many groups) there is a certain amount of "overdescribing"—that is, the creation of unnecessary names in regional studies when more comprehensive monographs would demonstrate that several supposed species are one and the same. Of course, it is as much the function of good taxonomy to point out such synonymies as it is to discover novelties.

It is true that there are vast groups in which many thousands of species remain unrecognized, groups such as the nematodes, mites and parasitic wasps—ironically, groups showing much host-specificity and of potentially great importance to agriculture. Nevertheless, I cannot go along with the estimate that only 15 percent of all organisms have been described; surely 50 percent is much closer to the truth.

And if this is the case, and about 1.5 million have so far been described, then the total may not exceed three million. This is depressing enough, or challenging enough, depending on one's mood. But it is not a cause for alarm. The task can and should be accomplished. Given the cost of only one moon shot, a great deal could be done in a few years, at least in a preliminary way.

Of course, no one pretends that to describe and

Time, unfortunately, appears to be running out for many species whose names we might never know.

Are they, in the words of an old nonsensical song, about to be "kicked in the head by a butterfly"?

name a species is to "know" it. This is only the first step to knowledge, but it is an essential step, not only because one needs to have a name for it, but because by placing it in a family and genus of organisms, one has the basis for predicting many things about it. This in itself serves as a guide to acquiring further knowledge. For example, I am currently describing a new wasp from Peru, placing it in the family Pompilidae (all members of which prey upon spiders and use one spider per nest-cell, so far as is known) and in the genus *Aporus* (known species of which prey on trapdoor spiders and have structural modifications associated with this behavior). Thus something has been grasped in the realm of the unknown and placed in a position where more can readily be learned about it—one knows where to look and, in gross terms, what to look for. Such a matter might be critically important in medicine or agriculture; and no one can predict to what use such knowledge might be put in elucidating the structure of an ecosystem or in demonstrating some principle of evolution or animal behavior.

Members of a genus share certain common features of structure and biology just as the genera comprising a family have fundamental similarities. A sound classification has enormous information content. Although the many categories recognized by the modern systematist may seem ponderous to the layman, in fact they reflect in remarkably concise fashion a vast body of sophisticated data. For Linnaeus, five categories sufficed. Such is our knowledge of living and fossil members of some groups that we now use more than 20 categories, from kingdom down to subspecies. The non-specialist may use as much or as little of this as suits his purpose. He may feel confident that if the classification is sound, it will lead him to almost any information he might require.

In the words of George G. Simpson, systematics "gathers together, utilizes, summarizes, and implements everything that is known about animals [and plants], whether morphological, physiological, or ecological." Our system of organizing this knowledge may not be perfect—but what is?

The time, also, is long past when taxonomists contented themselves with the gross features of dead museum specimens. They are studying organisms in all stages of their life cycle; they are revealing minute, wholly unexpected structural details by the use of scanning electron microscopy; they are analyzing behavior patterns, chromosome configurations, and even the sequence of amino acids in protein and nucleic acid molecules.

Modern classifications, of course, reflect these sophisticated approaches. This is a cause for alarm in some taxonomic quarters, as what seemed to be one species has sometimes proved to be several. By analyzing song patterns, B. B. Fulton and R. D. Alexander

have demonstrated that "the" field cricket of eastern North America is in reality seven species; although they could not be differentiated on the basis of dead specimens, they fail to interbreed in nature. Studies of egg color and structure, along with other biological features, revealed that "the" malaria mosquito of Europe was actually six species, only two of which actually transmit malaria effectively. Use of a minute parasitic wasp to control the California red-scale insect, a serious pest of citrus, led to inconsistent results until Paul DeBach and his colleagues discovered that what was thought to be one was actually seven different species, each having its own biological characteristics. This discovery provided a vastly improved basis for control and permitted the introduction of several new species of scale-insect parasites.

Such discoveries are exciting and of fundamental importance. We still pay homage to Linnaeus, but we have gone very far beyond the brief Latin descriptions of superficial features that sufficed for his day.

It is ironic that in our time, when ecology has truly become a household word, young systematists are having even more difficulty than usual in finding positions. In the words of Edward O. Wilson, writing in the journal *Ecology:* "Most of the central problems of ecology can be solved only by reference to details of organic diversity. Even the most cursory ecosystem analyses have to be based on sound taxonomy. . . . The food nets, the fluctuation of population numbers . . . the colonization of empty habitats . . . and most other basic topics of ecology, require a deep understanding of the biology of individual taxa." Yet there are large groups of organisms having only one or two specialists in the entire world, and sometimes none at all.

"It is the exclusive property of man to contemplate and to reason on the great book of nature. She gradually unfolds herself to him who, with patience and perseverance, will search into her mysteries." As a person caught in the turmoil and surfeit of our times, I have become blasé about a great many things and a doubter of many human enterprises and supposed values. But I have never questioned the sentiments expressed by Linnaeus in the above sentences from the introduction to his *Systema Naturae.*

I am not sure whether, at this stage, a more profound knowledge of the biosphere—including, as a first step, an inventory of living things—would save us from destroying the Earth as a viable habitat for Man. Perhaps not. But it would be nice to think that we tried at last to acquaint ourselves with the cast of that greatest of all dramas that began with a primordial soup and one day yielded a superb green world filled with remarkable creatures, including, at least for a few ticks of the cosmic clock, a being that imagined himself master of the Earth.

The curious naturalist may chase only the butterfly, but he'll find a lot more after he catches up.

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By Michael Durham

For the Swedes a prison sentence can be fun time

The nation's welfare system takes lawbreakers, too, under its permissive wing, giving them love, entertainment, even vacations

Sweden prides itself on having the world's most benevolent and progressive prison system, so it came as a shock when 15 of the nation's most dangerous criminals escaped in a group from the maximum-security prison at Kumla. The escape was executed with professionalism. More intriguing to Americans were the incidental descriptions of Swedish prison life.

The escapees had been considered too incorrigible to mix with other inmates, so were confined to a special wing, a prison within a prison, where escape should have been very difficult. But, according to news reports, this wing was positively resortlike. Indeed, two of the 17 men incarcerated there chose to remain rather than join the escape.

Amenities included private rooms with TV, a spacious dining area also with TV, a pantry where prisoners kept private food supplies, an exercise room, a workshop and a "love room" where the men could entertain female visitors privately. Apparently this last room was not used for love alone; it is suspected that the getaway was planned there.

Security at Kumla was lax. After bedtime there were no guards at the special wing, and the men blocked the listening devices that were supposedly monitoring them. The single key they somehow obtained opened all the doors. The workshop was equipped with, of all things, a hacksaw. With it, the escapees removed exercise bars from the workout room and used them to fashion a ladder to scale the unguarded wall.

Once free, the men conducted themselves with de-

Swedish prisoner greets his family in his own room at a minimum security prison. All prisoners

rate family visits, though in a closed prison they take place in a guarded "love room."

Photographs by John Dominis

Prisoner couple, in for drug dealing, ride bikes at a vacation village of cottages. They spend a month.

corum. Two who broke into an empty summerhouse left a thank-you note. All were rounded up quickly. And Swedish public opinion turned on Kumla for being too oppressive. How could this maximum-security prison be justified, anyway, people asked. With 435 inmates, it was too big for effective rehabilitation; its listening devices and TV monitors stifled individual expression; and by isolating hard cases, the prison was nurturing criminality and encouraging escapes!

Progressive prisons are an integral part of Sweden's "cradle-to-grave" welfare system. As one sociologist put it, "The state has an obligation to the primary victim of crime who is, in our view, the criminal." Prisons exist, therefore, for rehabilitation—"social learning." A penologist explained: "We used to assume that going to prison was like having your appendix out in a hospital. After you were free, everything would be fine. We now believe there should be fluid boundaries between prison and the outside world so that prisons become something more than walled compounds."

Keeping the boundaries fluid is the objective of the many innovations in Swedish prisons. One shares its workshop and schoolroom facilities with the community at large. In all the country's 68 institutions, prisoners with good behavior are allowed "furloughs." They are also allowed "conjugal visits" from wives or "fiancées," and in open prisons where inmates have the keys to their own rooms women may visit. Closed prisons like Kumla have love rooms.

Maintaining strong family ties, say the experts, makes rehabilitation easier. Homosexuality has been practically eliminated in prisons, authorities claim. More amazing, perhaps, is the sight of female employees walking the corridors of Kumla without escort.

Even the penal vocabulary has been altered. The word "prisoner" is no longer used. Swedes feel that their word *klient* better describes the inmates' relation to the welfare state. Prisons become "institutions," wardens "directors" and guards are *tillsynsnan,* a difficult-to-translate term that recognizes their intensive training. One director tried "male nurse."

There are 37 closed prisons in Sweden, some housed in turn-of-the-century fortresses that the Swedes want to phase out. Ultramodern Kumla is built around two large, walled courtyards housing the prison buildings and also an outdoor swimming pool, football field, miniature golf course and a school building. Inside it is light and airy. The spacious reception room where prisoners are brought is decorated with murals.

Prisoners are housed in small sections and, except for incorrigibles, are allowed to intermingle in dining, recreational and workshop areas. There are, of course, walls—but no guard towers. When a visiting American penologist suggested that barbed wire be strung on top to discourage escapees, his Swedish host protested that the well-being of the escaping prisoner must be considered. He might injure himself.

Michael Durham, a New York free-lance writer, is a former European correspondent for Life *and recently editor of the magazine,* On the Sound.

Sweden's 31 open institutions come closer to the Swedish ideal of what a prison should be. All are small —usually housing fewer than 100 inmates—for effective rehabilitation. On warm weekends the grounds are often filled with prisoners picnicking with visitors. There is little to prevent prisoners from escaping, and Sweden has one of the highest escape rates in the world. Generally the men simply walk away or fail to return from furloughs.

The overall prison picture in Sweden is one of overwhelming compassion, but sometimes Swedes display a compulsion to experiment that is chilling to foreign observers. In his highly critical study of Swedish society, *The New Totalitarians,* Roland Huntford, a British correspondent, reports a brainwashing project. Certain prisoners were to be kept on short rations which they would always receive from the same warder. The purpose was to make the prisoners psychologically dependent on him and thus rehabilitate them "by suggestion." The experiment was halted at the last moment, Huntford writes, "for fear of the immediate *political* consequences. There were no ethical reservations; it was assumed that, when public opinion was ripe, the attempt would be made."

The meticulous sense of fair play written into Anglo-Saxon law does not exist in Swedish justice. There are no juries in criminal cases. The defense attorney and the prosecutor, instead of maintaining an adversary relationship, are supposed to collaborate with the judge to present the best case possible for the state, according to Huntford. Yet only a small percentage of convicted criminals are actually sent to prison. More often they are fined and put under the supervision of probation officers. Women are imprisoned so rarely that there is only one women's prison in the country, with room for 100 inmates.

Most people who do land in prison have committed what we would consider a misdemeanor—drinking while driving. Once plagued by widespread slaughter on the roads, Sweden is so unforgiving on this count that a convicted driver may get up to four months if tests prove he had the equivalent of two drinks. These penalties are imposed indiscriminately. A favorite story tells of the bank director who returns to work "hale and hearty" after serving a sentence at hard labor and informs his associates he was vacationing in the South of France. Drug offenders make up another large part of the Swedish prison population. Swedes credit stiff penalties with staving off an influx of drugs.

Short terms preferred by courts

Two-thirds of the prison population serve less than four months. Short terms reflect the Swedish belief that prison should disrupt a man's relationship to family and society as little as possible. A few prison authorities admit they think such short sentences are counterproductive. How can penal institutions undertake to rehabilitate, they argue, when prisoners are incarcerated for such a short time?

The Swedish policy is to send a man to prison as close as possible to his home. In sparsely populated northern Sweden, where this is often impossible, the prison in Ulriksfors opened a hotel next to the institution where prisoners may spend weekends with family and friends. Most prisons, however, are in or near urban areas instead of far removed, as public pressure demands in the United States. Swedes take a remarkably tolerant view of their outcasts. Last year a young convicted thief in a closed prison in Gävle became engaged to a local girl he had met in a discotheque while on leave. Asked if he had told the girl at their first meeting that he was a prisoner, he looked puzzled. "Of course," he answered.

The Swedish prison system is notably willing to experiment. Some projects seem absurd at first glance, others are short-lived and inconclusive. These experiments are small—so small, say critics, they hardly benefit the average prisoner at all. But they are working

Prisoner-student (right) sits by the window on train ride home with family for 72-hour furlough.

examples of the world's most innovative penal thinking and provide a glimmer of what prisons of the future may be like in this remarkable country.

Vacation Village: Some Swedish penologists believe prisoners have a right to vacations like ordinary workers, and that vacations bolster family life which is the most important factor in a prisoner's rehabilitation. Three years ago the Correctional Administration acquired the entire village of Gruvberget with 23 small cottages from a lumber company. From spring through fall, selected prisoners may bring their families there for month-long stays. The prisoners are required to attend classes in the mornings in subjects which will, it is hoped, ease their eventual readjustment to society.

Each of the small, two-bedroom cottages has a kitchen, but most families dine free of charge in a central mess hall. Much of their ample free time is spent fishing and hiking through the forests of this remote region. To date, there have been no escapes, even though some wives bring cars, and families are permitted to take buses to the nearest large town. In theory, all prisoners are eligible for vacations at Gruvberget, although the village can only accommodate a small percentage. Last summer one "guest" was a famous Swedish sex murderer, who has since gained some renown as an artist. One of his paintings hangs in the warden's office. Another was serving a four-month sentence for driving while intoxicated. He admitted to being overwhelmed by his good fortune of being able to spend one-fourth of his term on a paid vacation.

No studies have yet been made to determine if vacations do actually help in rehabilitation. If asked to justify the program, authorities usually cite humanitarian reasons. "It certainly does no harm," said one, "and it might just do some good. Therefore, we are obliged to try it."

Study Farm: Swedes are fervent believers in the beneficial effects of education on prisoners and nonprisoners alike. In prisons with study facilities, prisoners may take courses as an alternative to laboring in the workshops. On the edge of the university town of Uppsala, there is a prison compound devoted to study.

The 20 prisoners at Studiegården, or "study farm," are housed in two barrackslike buildings beside a large playing field. Lower grades are taught on the premises, while more advanced students study at the university or adult education center in town. They travel to classes unescorted, usually on bicycles provided by the institution. The prisoners, mostly young, blend in easily with the town's student population and spend an unusual amount of time on passes from the study farm. (One young student-prisoner last summer kept a small car parked outside the prison gate for weekend trips to Stockholm.) Personnel assigned there consider themselves educators, not prison-keepers, so security is minimal. One recent escapee was returned to a closed prison as punishment, but only briefly. "We didn't want him to lose study time," said his supervisor.

The study farm's most publicized inmate was a flying student, who was allowed to take lessons at a nearby airport on condition that he be accompanied on all flights by a correctional officer. One story, perhaps apocryphal, concerns an inspection tour by Sweden's King Gustaf VI. After counting the men standing before him, the King remarked that one was missing. "He is right above you," the men told the dumbfounded monarch. "In an airplane."

Work Programs: In Sweden, honest labor is considered the most effective rehabilitation. Work programs have been relatively successful, although penologists admit that short prison terms leave insufficient time to train workers, and the vagaries of the marketplace make it difficult to keep prison industries busy.

The small, open prison at Tillberga has the most successful work program in the country. There 120 in-

Mingling with crowds on a street in Uppsala is a prisoner-student from the local "study farm."

mates construct the components for prefabricated housing to fulfill the constant demand for low-cost summer homes. Prisoner-workers punch a time clock and even indulge themselves in the privilege of lining up minutes before quitting time. The nonuniformed guards are also shop foremen, a role the prisoners sometimes resent. "They tell us to regard our jobs the same way civilians do," one said. "But that's not easy when the man you work for is also your keeper."

Last summer the prison began paying the men wages equivalent to those they would receive as free men doing equivalent work. The prisoner must save three-quarters of his earnings for forging a new life after prison, family support, or paying back debts, fines or court judgments.

Surprisingly, the prison at first had trouble recruiting volunteers for the program. Many prisoners were afraid their wages would be automatically turned over to creditors. Some who did volunteer lacked the necessary skills or were judged incapable of handling the responsibility of extra money. Others simply did not want to leave the secure, regulated life of a closed prison. This troubles prison officials because it negates the whole idea of prison reform.

Modified Therapeutic Community: Built in 1845, the closed prison at Gävle with its fortresslike exterior, barred windows and vaulted ceilings gives some idea of what Swedish prisons were once like. Gävle today is Sweden's most advanced experimental prison. Therapeutic communities, mostly associated with mental hospitals, are designed to rehabilitate by letting the inmate exercise some degree of control over his own life. Karl-Henrik Ström, Gävle's young director, says "We want people to work out their own problems."

Ström hired young guards who trained for a month together before the experiment started. Prisoners in the program are all volunteers with at least six months left to serve; yet apathy is the most serious problem.

At a daily meeting of staff and inmates, proposals are made and problems thrashed out, hopefully to everyone's satisfaction. Moderator Ström once reported that liquor had been smuggled into the prison and asked what should be done about it. The "discussion" that followed was marked by long, uncomfortable silences and angry outbursts from the prisoners.

"We still don't talk about things the way we should," Ström said afterward. "Drinking is a real problem for the prisoners, but even our staff would prefer not to discuss it. Every time we have a crisis there is always someone who says, 'We must pull ourselves together.' Usually it's a new man. Others want to have a conventional investigation, which means they want me to conduct it. Too often in crises we revert to our old ways."

Prisoners and staff recently worked out an arrangement by which prisoners could stay out of their cells until 11 P.M. to watch television without supervision. Ström was delighted. "It's silly to lock up grown men," he said.

Trying it on tough cases

The suitability of applicants to the program is also discussed. One faction would prefer model prisoners who can be trusted to participate in programs outside the prison, such as work release. Ström believes "we have the facilities for rehabilitation right here inside the prison. Let's get men who are tough cases and use these facilities."

Ström and other penologists are anxious to see how well a freewheeling experiment like Gävle can function within the bureaucracy of the Correctional Administration. To keep the experiment going, Ström must often throw away the rule book. Regulations in this closed prison require that the main door to the prisoners' quarters be barred. Yet it is often left open. Though faced with this opportunity to escape, only two prisoners so far have done so—and they chose traditional methods. One loosened a window bar and the other slipped through a hole left by workmen. "It was as if they didn't want to jeopardize the program by taking advantage of us," Ström explained. "I really appreciated that."

The Final Transition: Swedish prison administrators consider the state responsible for a prisoner's progress toward freedom. As part of an extensive "aftercare" program, released prisoners are assigned to supervisors, many voluntary, who counsel and help them find jobs and housing. Also, several halfway houses offer hospitality. The Björkahemmet Institution provides another form of transitional care. Located in a private home in a fashionable Stockholm suburb, the institution receives youthful offenders before their

final release. Its lively director, Lennart Wälivaara, confers with the administrators of youth prisons to find boys they deem ready to make the transition to freedom. A candidate must have already served at least five months. On arrival, he is put to work doing chores until an outside job is found. After he starts working he receives an allowance of 11 crowns (about $2.75) a day to enable him to save for the day when he is released. The boys are only loosely supervised and may go into Stockholm on weekends and certain evenings. About a dozen a year are returned to prison for misbehavior, mostly drug offenses. "When we think a boy has a chance to succeed here," Wälivaara says, "we can hide his offense in the report. If I write that so and so 'hasn't followed the rules of the gentleman's agreement,' it might mean I caught him smoking hash."

Wälivaara lives at the institution. His staff consists of a psychologist and a social worker, both women. "The boys know I can send them back to prison, so there is no way to have an equal relationship." His main goal is "reality training." "The boys carry the keys to their own rooms—a very important thing to everyone. Each boy has to ask himself, 'Can I handle the freedom?' Once he knows he can, we no longer have a problem."

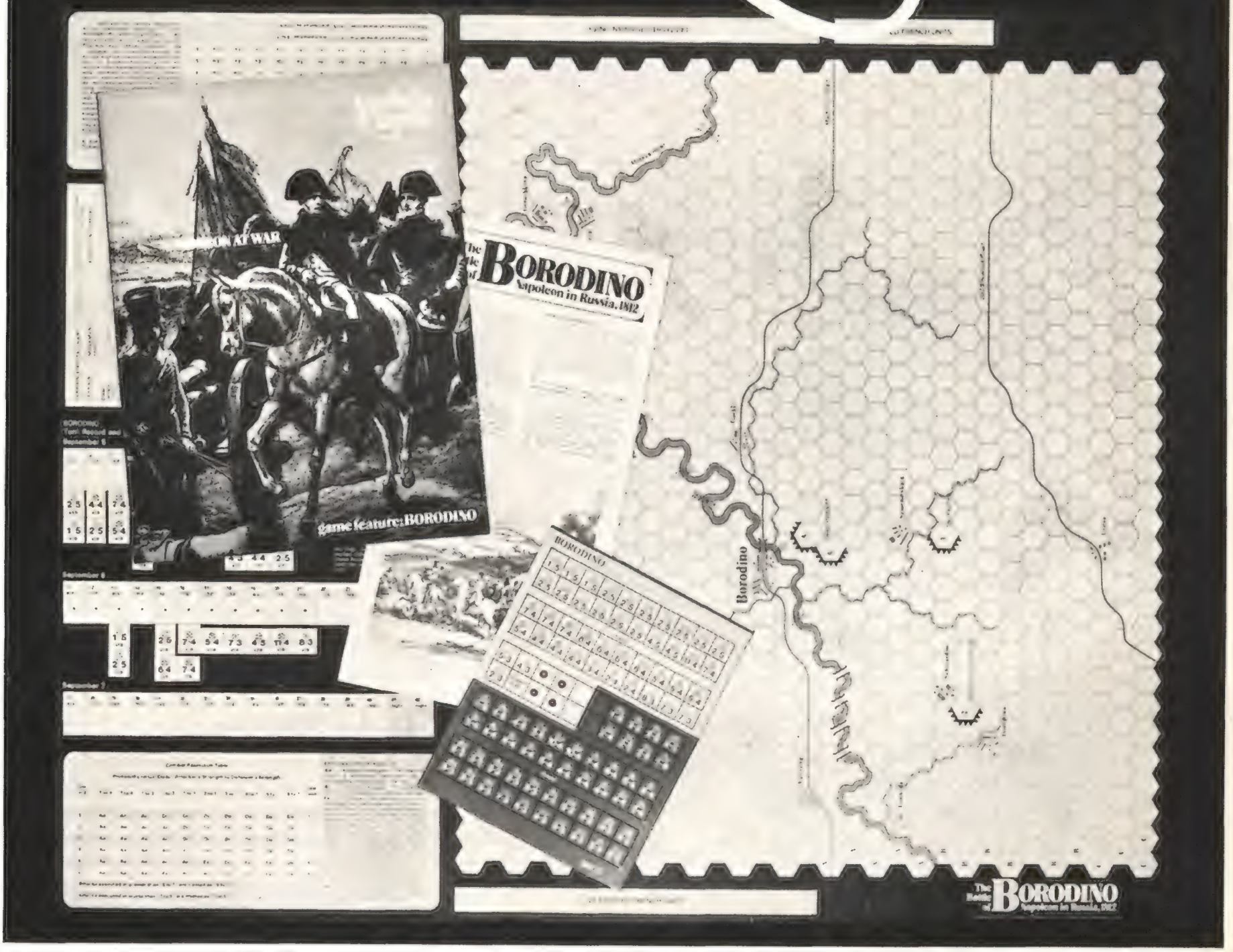
American penologists ask if the Swedish system works. Sweden has made little effort to evaluate the effects on crime, rehabilitation and recidivism, and, until it does, the system lacks value for other countries. But Sweden recently established a small research bureau within the Correctional Administration, headed by an Englishman, Norman Bishop, who has a wide knowledge of other systems.

"The great difference between the Swedish and American systems lies in the length of sentences," Bishop says. "We know we don't have less recidivism just because we send people out faster, but there's no evidence we have more either. There is, of course, a net gain to the state in that it costs 180 crowns (about $45) a day to keep a man in prison. And in terms of pure humanity, there is less incarceration, which is less dehumanizing."

Many American penologists also favor shorter sentences but despair of the political obstacles they must surmount to achieve them. Likewise, penologists recognize that American penitentiaries are far too large, but the cost of breaking them up into smaller units would be prohibitive. As Bishop says, "Swedes think that what is the most humane is necessarily the most effective, but that isn't always true."

Prisoners stroll with their wives and children at a vacation village. Classwork occupies the mornings.

Strategy & Tactics



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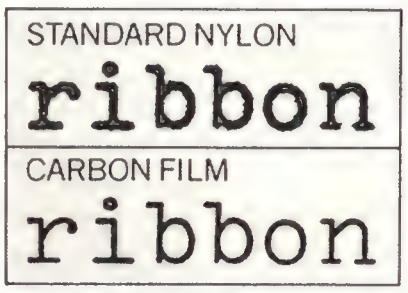

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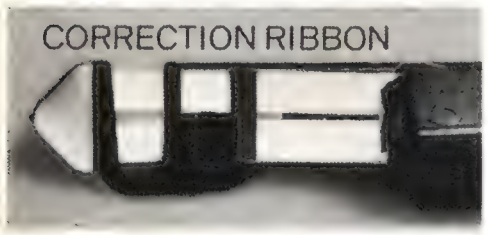

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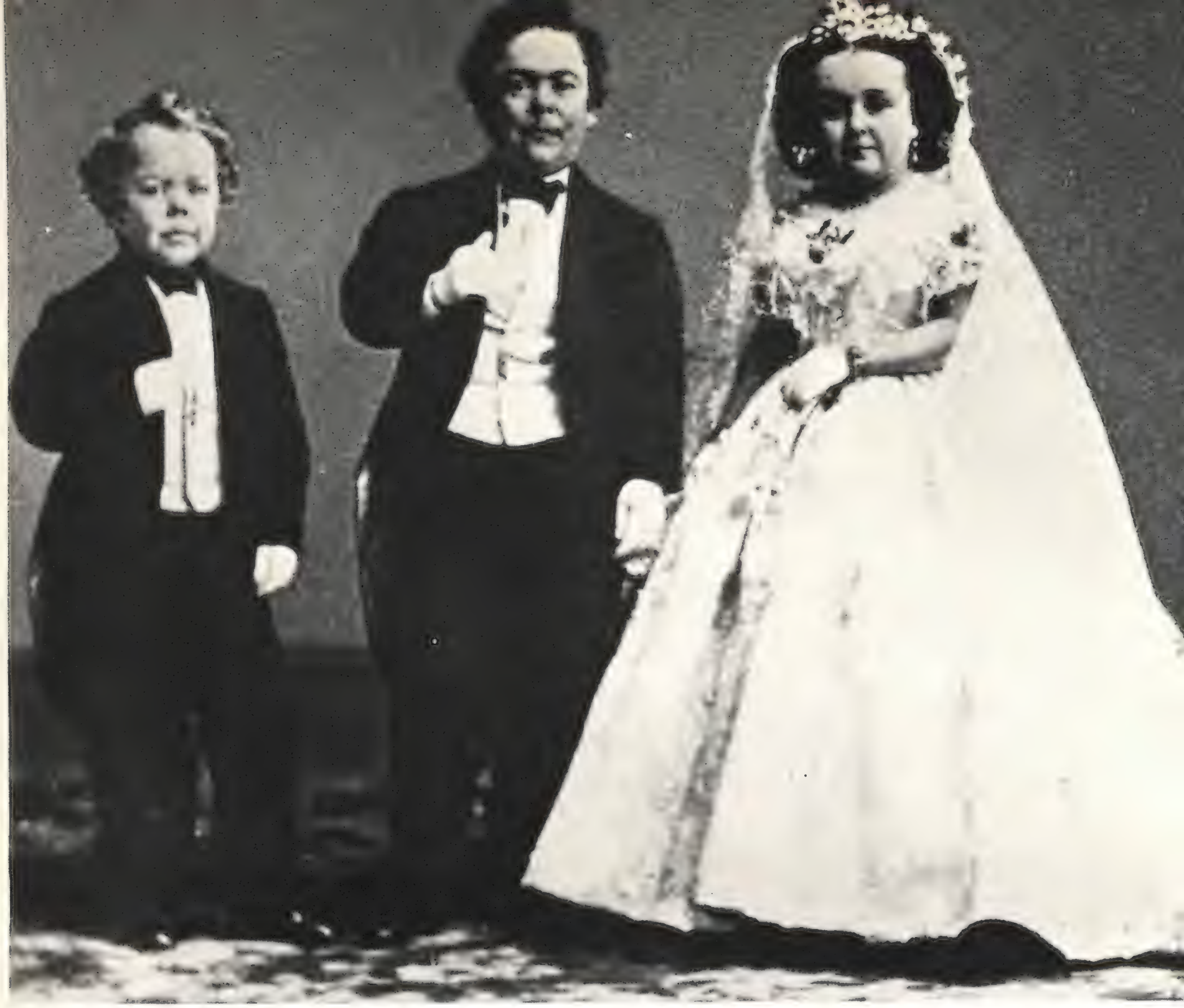


By Theodore James jr.

Tom Thumb's giant wedding

Less than a yard tall each, bridegroom and bride stole the heart of a nation torn by the Civil War, with help from P.T. Barnum

During the bloodiest of all our wars, people, as is their wont, sought diversion. The year was 1863, and the Battle of Fredericksburg, a tragic disaster for the Army of the Potomac, still rankled in the North. Although President Abraham Lincoln had just issued the Emancipation Proclamation, final victory seemed all but out of reach. The nation desperately craved distraction. And it came.

On February 10 the war of giants was pushed off the front page by a wedding of midgets, which took place at Grace Church on Broadway in New York City. P.T. Barnum's pint-sized performer, Tom Thumb, took two-foot-eight-inch Lavinia Warren as his bride. And not only did the marriage ceremony offer splendid pageantry, but the public hysteria which accompanied it and the ensuing honeymoon rivaled what

Tom and Lavinia are flanked by Commodore Nutt, the bridegroom's rival in love and later his best man, and the bride's even littler sister, Minnie Bump.

might have been expected to follow the announcement of the fall of Richmond or the burning of Atlanta.

The two-foot-11-inch, 25-year-old bridegroom was born Charles Sherwood Stratton to normal-sized, poor parents in Bridgeport, Connecticut, on January 4, 1838. He weighed in at a whopping nine pounds, two ounces, but by the time he was a year old he had stopped growing at the normal rate, and he soon stopped altogether. And by the time little Charles was five, the great Barnum—who always kept his ear to the ground for such possibilities—had found him and brought him out into the public eye.

Although Barnum referred to Thumb as "my dwarf," technically Tom was not that. A dwarf shares with a midget arrested growth. But dwarfs have normal upper bodies and stunted lower limbs, which may be caused by a malfunctioning thyroid gland and may result in a grotesque appearance. Midgets (many of them claim that the word is a Barnum invention and prefer to be called "little people") are perfectly proportioned copies of ordinary human beings, only on a smaller scale. Their pituitary glands may be defective and withhold growth hormones.

Barnum first sent Tom to tour the country as an Englishman (his Connecticut origin was regarded as too pedestrian by the great P.T.). He named him after Sir Tom Thumb who—according to one fairy tale—was one of King Arthur's knights, dwelt in a tiny gold palace with a one-inch-wide door and rode in a coach drawn by six white mice. Sir Tom was killed in a duel with a spider.

Barnum's Tom Thumb became a household word in America and Europe. As a child he was the subject of tiny children's books no bigger than a thumb. As he grew up, quadrilles and polkas were named after him. The President of the United States, Abraham Lincoln, and his family were charmed by him. And among the two million women he claimed he had kissed were the queens of England, Spain, France and Belgium.

When he arrived in Paris to meet Louis Philippe, a restaurant was named after him, snuffboxes bearing his face appeared in shops, and plaster casts of him graced hundreds of store windows. Louis Philippe presented him with a diamond-set emerald stickpin.

In London, he enchanted Queen Victoria by singing *Yankee Doodle* to her. He was introduced to the Duke of Wellington and did his famous impersonation of Napoleon for him. In Spain, he attended the bullfights with Queen Isabella. King Leopold of the Belgians received him at court.

By the time Tom Thumb was ready to wed, he had amassed a major fortune, owned a dazzling yacht, a stable of fancy horses and carriages and a substantial mansion in Connecticut furnished with Lilliputian furniture. When he met his bride-to-be he was on vacation, but had returned to Barnum's extravaganza in New York to see the first hippopotamus to reach the States. It was billed as "The great behemoth so frequently mentioned in the book of Job where it is declared that 'Upon Earth there is not his like.' "

Tiny 21-year-old Lavinia Warren, born Mercy Bump in Middleboro, Massachusetts, was presented by Barnum at a levee every afternoon as "The Little Queen of Beauty." Upon seeing her, Tom rushed to P.T.'s office and said, "Mr. Barnum, that is the most charming little lady I've met. I believe she was created on purpose to be my wife."

Author James, a New York writer, has published five books, including Fifth Avenue, *a lively history, and says he is presently at work on five more.*

General Tom Thumb wears his regalia about 1880. The room was decked out with furniture Tom's size.

Lavinia was, to quote the *New York Times,* "lively in conversation and speaks with all the confidence and even wit of an accomplished and talented woman. She is fond of poetry, music, eloquence and the fine arts generally; indeed she is quite as charming mentally as she is physically. Her eye is bright, her smile sweet, her hair dark and her figure perfection itself. Really she, so far as she goes, is externally all that the most fastidious of the lords of creation could desire, and if all that is told of her feminine virtues be correct, she will prove to the gallant Tom a treasure far greater than greenbacks."

Lavinia was also full of Yankee spunk. She was an active member of the DAR, was adept at cooking, sewing and knitting and had taught school to towering third-graders.

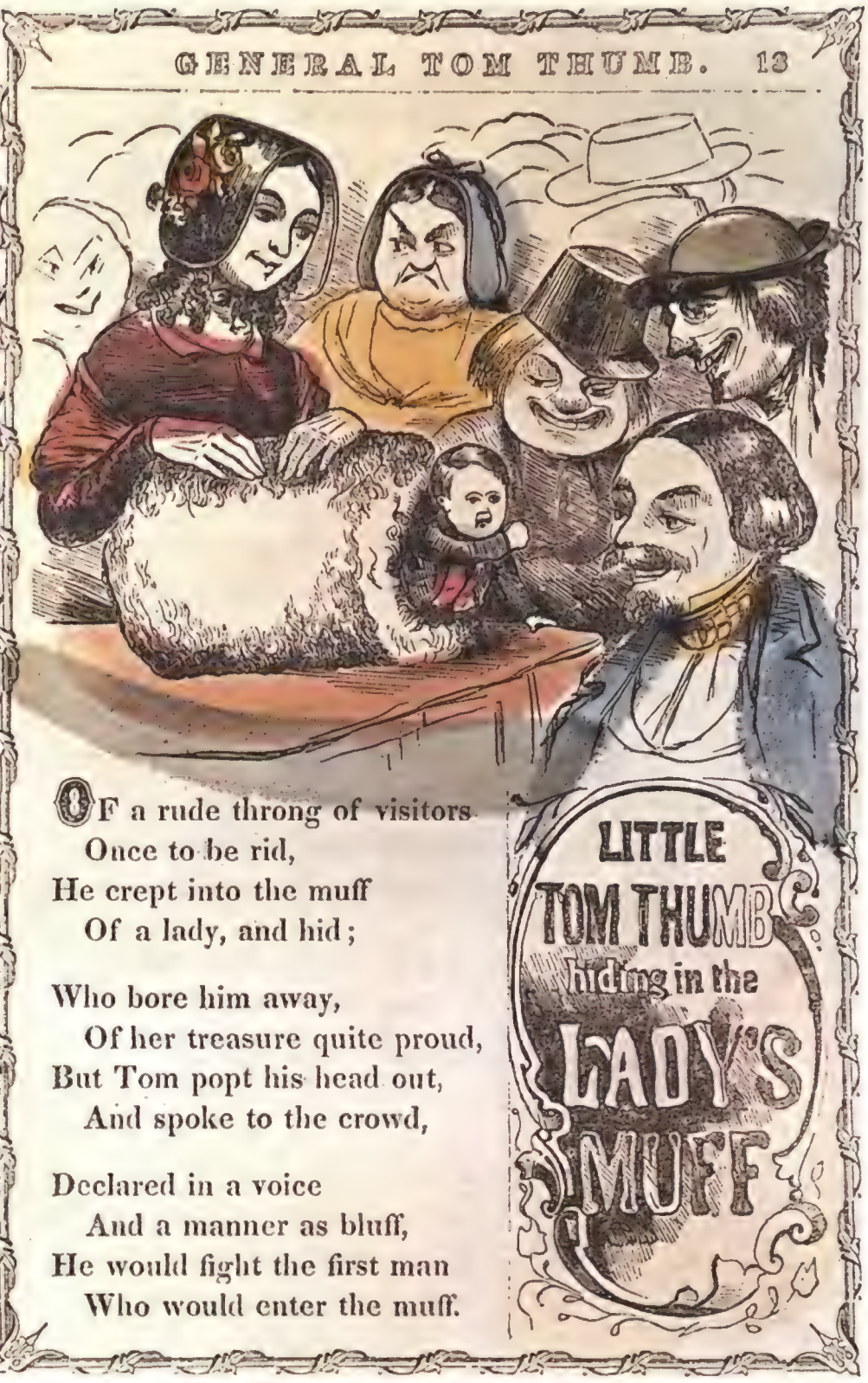
However, her extraordinary charms had been discovered by another. Two-foot-five-inch Commodore Nutt, billed by Barnum as the "$30,000 Nutt," had fallen in love with her. It was rumored that a knockdown battle had taken place between him and Tom, during which Nutt landed a tiny fist smack on Tom's nose. Ultimately Tom won Lavinia's favor. In the wake of rejection, Nutt grew morose and frightfully thin. But eventually he recovered and became a lifelong friend of the couple.

Lavinia took Tom home to meet her family, and the engagement was announced. Barnum, ever alert to a fast buck, saw the commercial probabilities and drummed up enough interest to assure floods of humanity at his emporium. Some 20,000 curiosity-seekers paid $3,000 a day to view Lavinia and her engagement ring. As the wedding date approached, the billing became more flamboyant. "Now or Never," read the pamphlets. "The 6,000 years of the world's existence has never produced her equal before," screamed the advertisements. Poets were inspired to write verses dedicated to the fair Lavinia:

Nature's miniature often fair lady, I've seen
But ne'er saw one before from all blemishes free.
'Tis no wonder they style thee of beauty the queen:
For Eugénie herself must surrender to thee. . . .

Lavinia continued to receive until three days before the wedding. At that point Barnum offered the couple a staggering sum to continue appearing, but reason and devotion overcame greed and they retired to prepare their wedding.

And what a wedding! It was to be a small family affair, but the couple yielded to pressure and decided to expand the guest list to 2,000 of "the elite, the crème


GENERAL TOM THUMB. 13
OF a rude throng of visitors
Once to be rid,
He crept into the muff
Of a lady, and hid;
Who bore him away,
Of her treasure quite proud,
But Tom popt his head out,
And spoke to the crowd,
Declared in a voice
And a manner as bluff,
He would fight the first man
Who would enter the muff.
LITTLE
TOM THUMB
hiding in the
LADY'S
MUFF

A Tom Thumb coloring book, filled with supposed episodes of his childhood, delighted the nation.

de la crème, the upper ten, the bon ton, the select few, the very FF's of the City—nay of the Country," according to the *Times* in a moment of jubilant enthusiasm. Astors, Vanderbilts, Belmonts and Roosevelts attended, along with senators, congressmen and diplomats. Some 15,000 people made application, offering up to $75 a ticket to view the service. Others sent extravagant gifts in hopes of wresting an invitation.

Several days before the event, the uninvited started leaving town "on the advice of the doctor" to avoid the chagrin of not being included among the chosen few. Finally, a public notice appeared in the papers: "Money will not purchase wedding cards." Small children played with Tom Thumb Wedding Party paper dolls while their older sisters played *The Fairy Bride Polka* and *General Tom Thumb's Wedding March* on their pianos.

Originally, the ceremony was to have taken place at Trinity Church; however, the rector put his sanctimonious foot down and said "No." Grace Church at Broadway and 10th Street was then selected. Hours before the sun came up on the morning of February 10, 1863, crowds of people jammed the streets near the church. Every window, door and balcony in the vicinity was packed with spectators. Broadway had been blocked from 9th to 12th Streets and the police set up barricades and formed human chains to contain the immense crowd. At noon the wedding carriage drew close to the church. Cheers went up and crowds surged toward the carriage. The police barely managed to contain the mass.

The *New York Herald* said, "If we had thought a delicious jam outside, what shall we say of within? Here indeed was the true 'vision of fair women.' Here was the carnival of crinoline, the apotheosis of purple and fine linen. Never before was the scarlet lady seen to such advantage. Babylon was a rag fair [compared] to it." The *Observer* called it "the event of the century, if not unparalleled in history."

Thousands of tulips were banked along the altar and aisles, where an honor guard of snappy policemen stood at attention. The organist supplemented the traditional wedding music with the overtures to *William Tell* and *Oberon*. There were several false alarms, but finally at 12:30, a half-hour late, the great Barnum made his way up the aisle.

Elegant citizens climbed on pews

Pandemonium! New York's most elegant citizens threw breeding and manners to the wind. Shouts of "They come!, they come!" rang beneath the Gothic vaulting. Grande dames and budding socialites leaped onto pews and some climbed on their husbands' backs for a look at the Lilliputian pair.

Lavinia wore a snowy satin dress with a flowing train and decorated with a superb point lace bertha. Her hair was rolled *à la Eugénie* in front, and elaborately puffed in back. Her veil was interwoven in her hair. Above her brow she wore a diamond star and orange blossoms. Her bouquet was of roses and camellias. Her white satin slippers were adorned with rosettes and seed pearls. A diamond necklace hung around her neck and two diamond pins fastened her veil. These were gifts of the groom.

Tom wore a full dress suit of fine black cloth, a vest of white corded silk, a blue silk undervest, white gloves and shiny boots.

From atop a piano, the bridal party presides at the reception in New York's Metropolitan Hotel.

The best man was Commodore Nutt, and two-foot-one-inch Minnie, Lavinia's sister, was maid of honor. Though giggles rang out during the service, the *Times* reported that it was "done decently and in order. After Dr. Taylor gave the benediction, the General kissed his wife and, in the presence of the entire audience, bestowed upon her the 'killing' glance with which he has, in days gone by, captivated so many millions of equally susceptible damsels."

Hundreds of people chased the wedding carriage to the Metropolitan Hotel where the reception was to be held. Here again, the streets were blocked off and jammed with spectators. On either side of the entrance hung huge American flags. Pickpockets had a field day: Two were caught red-handed and taken to jail.

Inside the hotel, the spacious parlors were thrown open to guests. First stop was the bride's quarters, where the presents were displayed. A stout policeman guarded the dazzling jewel case, which was the major attraction. Mrs. Astor gave a coral leaf brooch and earrings with a diamond center, Mrs. Cornelius Vanderbilt "magnificent pearls," and Mrs. Livingston a set of silver goblets and salver. August Belmont gave a miniature set of charms, and Mrs. Belmont a necklace of Tuscan gold. Tiffany presented a silver horse and chariot encrusted with rubies.

President and Mrs. Lincoln were unable to attend, but sent an exquisite set of Chinese fire screens. Edwin Booth gave a pair of tiny slippers. Barnum sent a curious machine, a basket of polished tortoise shell. Upon touching a spring, a little bird clad in natural feathers rose and sang sweet songs. It was valued at $1,000.

Tom's presents to his bride were the most extravagant of all. Valued at $10,000, they included a diamond brooch, earrings and necklace; one pair of diamond bracelets and diamond hairpins to match; two diamond rings, one crowned with a cluster and one having a single stone; one green enameled watch set with diamonds; a coral-and-emerald brooch and matching earrings; a set of brooch, earrings and sleeve buttons in blue enamel set with rose diamonds.

After the couple descended the stairs and melted into the midst of their well-wishers, squeals of delight pierced the jovial din: "How graceful!", "Did you ever?", "Darling little creatures!" Finally the Tom Thumbs, Commodore Nutt and young Miss Minnie were guided to a pedestal on top of the piano, where they were placed by an athlete named Dibble. They

Tiny honeymooners settle down (with some help, apparently, from the big people) in their hotel suite.

greeted their guests with a nod or a shake of the head, and there was no doubt in anyone's mind that they were quite accustomed to the fuss.

The cake, a gift from a local caramel depot, was in the form of an exquisite confectionery tower with four cupids on it. It weighed in at 80 pounds.

Later that evening, the New York Excelsior Band, along with thousands of revelers, jammed the streets outside the hotel. The band played *The Land of the Free, the Home of the Brave,* and Tom appeared on the balcony. After thanking everyone he said, "But ladies and gentlemen, the little woman in the adjoining apartment is very anxious to see me. I must therefore make this speech, like myself, *short.*"

The following day the Thumbs were off on their wedding trip, which included visits to Philadelphia and Washington. The Lincolns gave a reception for them at the White House. Young Tad Lincoln couldn't keep his eyes off them and thought that Lavinia looked rather like his mother. He finally said, "Isn't it funny that Father is so tall and Mr. and Mrs. Thumb are so little." Lincoln overheard the comment and said, "My boy, God likes to do funny things. Here you have the long and short of it."

And so the war-weary public was distracted and delighted. True to form, the *World* ran a sobering editorial the day after the wedding: "The contrast which was yesterday forced upon the mind between the heated frivolity of the crowds which thronged Grace Church and blockaded Broadway, and the terrible realities which impend unheeded over every man and woman of all those giggling thousands, excludes for the time, all other considerations. It was too startling to be overlooked. It is too sad to be dwelt upon. We set it before our readers and leave its lesson to their conscience and heart."

Twenty years later in 1883 Tom died of apoplexy. He had gone through a great deal of his money, leaving Lavinia only about $16,000. She eventually married an Italian count named Primo Magri, also a midget, who had worked for her late husband.

A rumor persisted of an heir. This was only one of Barnum's inventions for the sake of publicity. Although midgets are tiny, their children are born normal size, and Lavinia's sister Minnie, who was married to Major Edward Newell, died during childbirth.

At the age of 78, in 1919, Lavinia died and was buried next to Tom.

Respectfully dedicated to

GENERAL TOM THUMB & LADY

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Glass. It's a natural.

Venus is seen floating in the sky, serene, featureless and mysterious, shielded by an unbroken cloud layer, as photographed by C. F. Capen through the 82-inch reflector at McDonald Observatory in Texas. Here, at quarter phase on May 29, 1967, Venus is tilted three degrees to the right from due north at the top.

By Carl Sagan

A detective story in astronomy: what Venus may be like

Once believed to be a home for mythical humanoids, our enigmatic neighbor is viewed now as a place that Dante would recognize

The planet Venus floats, serene and lovely, in the sky of Earth, a bright pinpoint of light. Seen or photographed through a telescope, a featureless disc is discerned; a vast, unbroken and enigmatic cloud layer shields the surface from our view. No human eye has seen the ground of our nearest planetary neighbor.

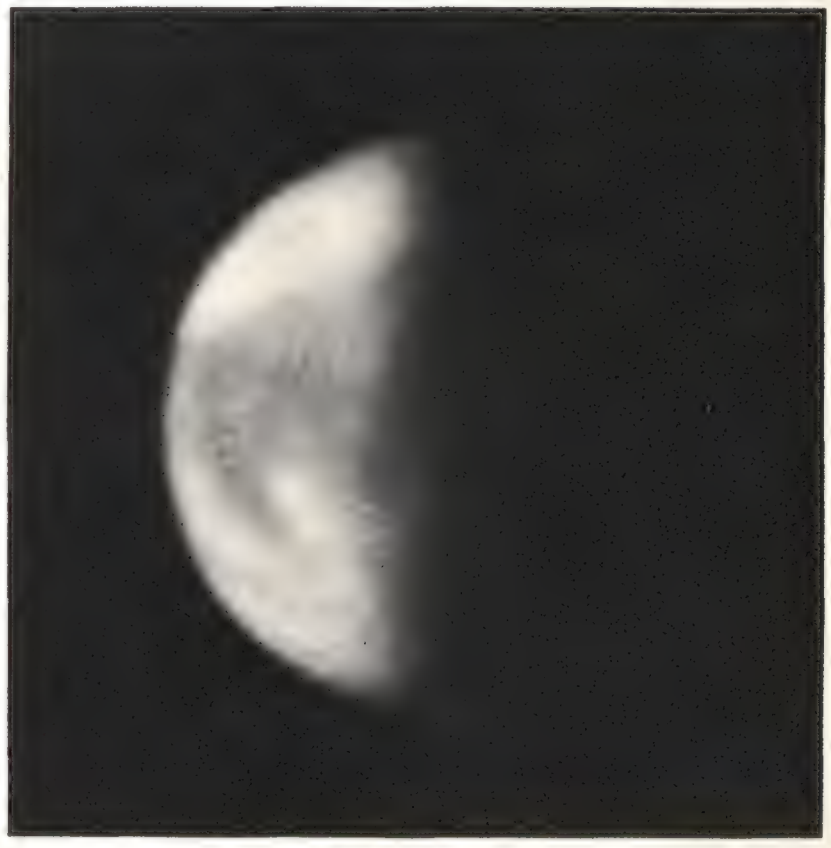
Even so, one of the reasons that planetary astronomy is such a delight these days is that it is possible to find out what's really right. In the old days, you could make any guess you liked, however improbable, about a planetary environment, and there was little chance that anyone could ever prove you wrong. Today, spacecraft hang like swords of Damocles over each hypothesis spun by planetary theoreticians, and the theoreticians can be observed in a curious amalgam of hope and fear as each new burst of spacecraft planetary information comes winging in.

Back when astronomers had telescopes, eyeballs and very little else to assist their observations, Venus beckoned as a sister world. By the late 19th century, it was known that Venus had about the same mass and radius as Earth. Venus is the closest planet to Earth, and it was natural to assume that it was Earthlike.

Immanuel Kant imagined a race of amorous quasi-humans on Venus. Emanuel Swedenborg and Annie Besant, a leader of theosophy, found—by methods described as spirit travel and astral projection—creatures very like humans on Venus. In more recent years, some of the more spectacularly audacious flying-saucer accounts—for example, those of George Adamski—populated Venus with a race of benign and powerful beings, many of whom seem to have been garbed in long hair and long white robes—clear symbolism, in pre-1963 America, of deep spiritual intent. There is a long history of wishful thinking, bemused speculation, and conscious and unconscious fraud, which produced a popular expectation that our nearest planetary neighbor is habitable by humans, and is possibly even already inhabited by creatures rather like us.

It was, therefore, with a sense of considerable surprise, and even annoyance, that the results of the first radio observations of Venus were greeted. These measurements, performed in 1956 by Cornell H. Mayer and colleagues at the U.S. Naval Research Laboratory, found Venus to be a much more intense source of radio emission than had been expected. From Venus' distance to the sun and the amount of sunlight it reflects back to space, the planet should be cool. Because Venus reflects so much sunlight back to space, its temperature ought to be even less than the Earth's, despite its closeness to the sun. Mayer's group found that Venus, at a radio wavelength of 3 centimeters, was giving off as much radiation as it would if it were a hot body at a temperature of about 600 degrees Fahrenheit. Later observations with many different radio telescopes at many different radio frequencies confirmed the general conclusion that Venus had a "brightness temperature" of about 600 degrees to 800 degrees.

Nevertheless, there was great reluctance in the scientific community to believe that the radio emission



Some detail shows as Venus is photographed in ultraviolet (by New Mexico State University). Markings show varying depths in its cloud deck.

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Mariner 10, which will be launched in November for flight past Venus and Mercury, is seen in final assembly and test by hooded, coveralled Boeing engineers.

came from the Venus surface. Why should Venus be different from the Earth? How could the surface of Venus be kept so hot? These doubts were raised—since psychological factors may be unconsciously compelling, even in science—partly because a Venus hotter than the hottest household oven is simply less pleasant a prospect than a Venus populated, in the long tradition from Kant to Adamski, by gracious humans.

This problem of the origin of the Venus radio emission was a major part of my doctoral dissertation. I wrote some twenty scientific papers concerning it. There were several things we knew about Venus. We knew how the brightness temperature varied with radio frequency. We knew how Venus reflected back to Earth radio waves sent out by radar telescopes. Man's first successful planetary probe—the United States' *Mariner 2*—found in 1962 that Venus was brighter at radio wavelengths at its center than at its edge.

To be matched against such observations were a variety of theories. They fell into two general categories: The hot-surface model, in which the radio emission came from the solid surface of the planet; and the cold-surface model, in which the radio emission came from somewhere else—from an ionized layer in the atmosphere of Venus, or from electrical discharge between droplets in the clouds of Venus, or from a hypothesized great belt of rapidly moving, electrically charged particles surrounding Venus (like those that, in fact, surround the Earth and Jupiter). These latter models permitted the surface to be cold by placing the intense radio emission above the surface. If you wanted sailing ships on Venus, you were a cold-surface model advocate.

Just before the remarkable spacecraft observations of Venus of 1967, I submitted a paper to *Nature*, the British scientific journal, in which I summarized this confrontation between the absorption and hypothesis and deduced that only the hot-surface model was consistent with all the evidence. I had earlier proposed a specific theory, in terms of the greenhouse effect, to explain how the surface of Venus could be at such high temperatures. But my conclusions against cold-surface models in 1967 did not depend upon the validity of the greenhouse explanation: It was just that a hot surface explained the data and a cold surface did not. Because of my interest in exobiology, I would have preferred a habitable Venus, but the facts led elsewhere. In a paper published in 1962, I had concluded from indirect evidence that the average surface temperature on Venus was about 800 degrees F and the

average surface atmospheric pressure about fifty times larger than at the surface of Earth.

In 1967, an American spacecraft, *Mariner 5,* flew by Venus, and a Soviet spacecraft, *Venera 4,* entered its atmosphere. To the end of 1972 there had been five Soviet instrumented capsules that entered the Venus atmosphere. The last three touched down and returned data from the planetary surface. They were the first craft of mankind to land on the surface of another planet.

My early conclusions were approximately correct, just slightly conservative: The average temperature on Venus is about 900 degrees F; the average pressure at the planet's surface appears to be about 90 atmospheres.

It is interesting, now that we know by direct measurements the actual conditions on Venus, to read some of the criticism of the hot-surface model published in the 1960s. For example, *Venera 4* radioed its last temperature/pressure point at 450 degrees F and 20 atmospheres. The Soviet scientists concluded that these were the surface conditions on Venus. But ground-based radio data had already shown that the surface temperature must be higher. Combining radar with *Mariner 5* data, we knew that the surface of Venus was far below where the Soviet scientists concluded *Venera 4* had landed. It now appears that the designers of the first *Venera* spacecraft, believing the models of cold-surface theoreticians, built a relatively fragile spacecraft, which was crushed by the weight of the Venus atmosphere far above the surface.

At the 1968 Tokyo meeting of COSPAR, the Committee on Space Research of the International Council of Scientific Unions, I proposed that the *Venera 4* spacecraft had ceased operating some fifteen miles above the surface. My colleague, Professor A.D. Kuzmin, of the Lebedev Physical Institute in Moscow, proposed that *Venera 4* had landed atop a high mountain. I argued that ground-based radar studies of Venus had shown mountains a mile high, at most, and that it was exceptionally unlikely *Venera 4* would land on the only 15-mile-high mountain on Venus, even if such a mountain were possible. Professor Kuzmin replied by asking me what I thought was the probability that the first German bomb to fall on Leningrad in World War II would kill the only elephant in the Leningrad zoo. I admitted that the chance was very small, indeed. He responded, triumphantly, with the information that such was indeed the fate of the Leningrad zoo's solitary elephant.

The designers of subsequent Soviet entry probes were, despite the Leningrad zoo, cautious enough to increase the structural strength of the spacecraft in each successive mission. *Venera 7* was able to withstand pressures of 180 times that at the surface of the Earth, a quite adequate margin for the actual Venus surface conditions. It transmitted 20 minutes' worth of data from the Venus surface before being fried. *Venera 8,* in 1972, transmitted more than twice as long.

Venus' gravity is about as strong as the Earth's, but there are about 90 times more molecules in the atmosphere of Venus than in the atmosphere of Earth. This dense atmosphere probably acts as a kind of insulating blanket, keeping the surface hot through the greenhouse effect and smoothing out temperature differ-

This article is taken from two chapters of Cornell astronomer Carl Sagan's new book, The Cosmic Connection, *to be published this fall (Doubleday).*

ences from place to place. The pole of Venus is probably not significantly colder than its equator, and it is as hot at midnight as at noon.

Forty miles above the surface is the thick cloud layer that we see from Earth. At least until recently, no one knew the composition of these clouds. I had proposed that they were constituted in part of water, a cosmically very abundant material, which could account for many but by no means all of the observed properties of the Venus clouds. But there were many other candidate materials proposed—among them ammonium chloride, carbon suboxide, various silicates and oxides, solutions of hydrochloric acid, a hydrated ferric chloride, carbohydrates, and hydrocarbons. These last two materials were proposed by Immanuel Velikovsky in his speculative romance *Worlds in Collision,* to provide manna for the Israelites during their forty years of wandering in the desert. The other candidate materials were proposed on somewhat firmer grounds. Yet each of them ran afoul of one or more of the observations.

But recently a material has been proposed that is in excellent quantitative agreement with all of the measurements. The American astronomer Andrew T. Young has shown that the clouds of Venus are very likely a concentrated solution of sulfuric acid. A 75 percent solution of H_2SO_4 precisely matches the index of refraction of the Venus clouds determined by polarimetric observations from the Earth. No other plausible material comes close. Such a solution is liquid at the temperatures and pressures at which the Venus clouds reside. Sulfuric acid has an absorption feature, determined by infrared spectroscopy, at a wavelength of 11.2 microns. Of all the materials proposed, only H_2SO_4 has such an absorption feature. The Soviet entry spacecraft of the *Venera* series have found large quantities of water vapor below the visible clouds of Venus. Ground-based observers looking for water vapor spectroscopically have found only a tiny amount of water vapor above the clouds of Venus. The two observations are in accord only if a very effective drying agent is present between these two regions. Sulfuric acid is such an agent.

In the Earth's atmosphere there are water droplets at altitude, and water vapor in the atmosphere below. Likewise on Venus: If there are sulfuric acid droplets in the high clouds, there must be gaseous sulfuric acid below, with a relatively high concentration near the surface. Astronomers in Earthbound observatories have also found unmistakable evidence of hydrochloric and hydrofluoric acid as gases in the upper atmosphere of Venus. They also must exist in a fair concentration—for example, the relative proportions of Los Angeles smog in Los Angeles air—in the lower atmosphere of Venus. These three acids are an extremely corrosive mixture. Any spacecraft that is to survive on the Venus surface must not only be bulwarked against the high pressures but protected against the corrosive atmosphere.

The time will come, in not too many years I think, when we will have our first photographs of the surface of Venus. What does the surface of Venus look like? To some extent we can already make predictions.

Purple mountains and blue sky

Because of the very dense atmosphere of Venus, there are some interesting optical effects. The most important such effect is due to Rayleigh scattering, named after the British Lord Rayleigh. When sunlight strikes a clear, dust-free atmosphere of the Earth, it is scattered. Photons strike the molecules of the Earth's atmosphere and are bounced off. Many such bounces may occur. But because the molecules of air are very much smaller than the wavelength of light, it turns out that short wavelengths are scattered or bounced away by the air molecules more efficiently than long wavelengths. Blue light is scattered much better than red light. This was a fact known to Leonardo da Vinci, who painted distant landscapes in an exquisite cerulean blue. It is why we talk of purple mountains; it is why the sky is blue.

When we look at a sunset we are seeing the sun through a longer path in the Earth's atmosphere than when we view it at noon. Blue light has been preferentially scattered out of this path, leaving only the red light to strike our eyes. The beauty of the sunset, the sky, and distant landscapes are all due to the effect of Rayleigh scattering.

What about Rayleigh scattering on Venus? Because the atmosphere is so much denser, Rayleigh scattering there is much more important. Were we to strip the

In detail of a Chesley Bonestell painting, *Mariner 10* hurtles toward the face of Venus as of early February next year. A month later it will fly past Mercury, having sent 8,000 pictures of the two planets.

clouds off Venus, we would still be unable to see its surface from above. Visible light of all colors would be scattered so many times in the Venus atmosphere that no image of any surface details would be discerned. In the near infrared, at wavelengths longer than the human eye is sensitive to, the surface could, however, be seen from above. But there are clouds.

Radio waves, however, can penetrate the clouds and the atmosphere of Venus, and the first radar maps of Venus are being developed. In a few years, Cornell University's great Arecibo telescope in Puerto Rico will begin mapping the surface of Venus by radar with great precision. Recent high-resolution radar studies from the Jet Propulsion Laboratory in Pasadena show an abundance of huge, shallow craters, probably of impact origin.

At the surface of Venus, Rayleigh scattering is also an extremely important effect. Just as we cannot see the surface in visible light from above Venus, we cannot see the sun in visible light from the surface of Venus—even if there were a break in the clouds. If there were intelligent life on Venus, astronomy would be very slow to develop; and radio astronomy would likely emerge first. The *Venera 8* spacecraft found that sunlight does reach the surface of Venus during the day, but it is so attenuated by passage through the clouds and atmosphere that, even at midday, it is no brighter on Venus than at twilight on the Earth. The sunlight would be a hazy and diffuse patch of deep ruby red light, whose rising and setting could only indistinctly be determined.

If you were standing in some protective suit on the surface of Venus and put on violet sunglasses, you could see no farther than a few dozen feet. The Rayleigh scattering in violet light is so strong on Venus that the visibility in the violet is small. But because long wavelength light is scattered less than blue, at the extreme red end of the visible spectrum—with red sunglasses on—you could see a few hundred feet. At the surface of Venus everything would be suffused in a deep red gloom. We would have a perception of color, but only for objects very close to us. Our surroundings would be an indistinct roseate blur.

Venus thus seems to be a place quite different from the Earth, and alarmingly unappealing: Broiling temperatures, crushing pressures, noxious and corrosive gases, sulfurous smells, and a landscape immersed in a ruddy gloom.

As seen in Ludek Pesek's paintings, based on Dr. Sagan's theories, the atmosphere of Venus obscures the light of the sun, rendering the landscape an indistinct and hellish roseate blur.

Curiously enough, there is a place astonishingly like this in the superstition, folklore and legends of men. We call it Hell. In the older belief—that of the Greeks, for example—it was the place where all human souls journeyed after death. In Christian times it has been thought of as the post-mortem destination of one of two categories of moral persuasion. But there is little doubt that the average person's view of Hell—sizzling, choking, sulfurous and red—is a dead ringer for what we now believe to be the existing conditions on the surface of Venus.

Although terrestrial biological molecules would fall to pieces rapidly on Venus, there are organic molecules —for example, some with a complex ring structure— that would be quite stable under the conditions of Venus. It is difficult rigorously to exclude life there, but we can certainly say it would be quite different from what we are familiar with. Any organism that lives there would be wise to have leathery skin. Because of the high atmospheric pressures, it would even make sense to have little stubby wings, which could carry their possessors about without exceptionally strenuous flapping. A devil is a very good model—except for his mannish and goaty aspects—for an inhabitant of Venus. Milton and Isaiah called Lucifer "Son of the Morning," the morning star. For thousands of years Venus and Hell have been identified.

This is all a very curious coincidence, but I cannot bring myself to think that it is anything more than that. The chief point is that in all the legends one gets to Hell by going down, not up. The classical world of Greece and Rome and the ancient Near East was peppered with active volcanoes. Such volcanic terrains, as in contemporary Iceland and Hawaii, are bleak, desolate and eerily beautiful landscapes. Sulfurous gases emanate from volcanic vents; lava fountains and flows suffuse the surroundings in red. It is very hot; you singe your eyebrows if you get too close to the lava in a collapsed lava tube. And all this heat, redness and smell come from down below. It was not very difficult for our ancestors to imagine that volcanic terrains were apertures to a quite different igneous world called Hell.

The inside of the Earth and the outside of Venus are alike but not identical. They are both unpleasant for humans. But they are both of extreme scientific interest—worth at least an extended visitation, if not a homesteading. Dante knew about that.

If an observer were to wear red sunglasses, hilly details would emerge (below) from gloom.

Photographs by Farrell Grehan

Future is famine for ten million south of Sahara

Impelled by drought, the desert moves south, turning livestock to bones and farmland to dust, while too little help arrives too late

The meteorologists' term is formal and dry: intertropical convergence zone. That is where the trade winds from the north and south meet in the vicinity of the equator, causing updrafts and clouds. Each year when the zone itself drifts northward over Africa, the rainy season begins along what is called the "Sahel," the southern border of the Sahara. From June to October the parched lands bloom and the nomads' cattle and goats grow fat.

It may be that the air currents of the intertropical convergence zone lost some of their strength. Or perhaps the water temperature of the nearby Atlantic dropped slightly, lowering the moisture content of the low-level winds that feed into the intertropical convergence zone. Or perhaps there was a weakening of the much higher, faster easterly winds that blow over the continent, affecting Africa's rains and India's monsoons. In any event, some such comparatively small and maybe semi-permanent perturbation in the dynamics of the global climate has forced six African nations over the brink of catastrophe. It is by no means the first time within living memory, but for four years now—in Mali, Senegal, Mauritania, Niger, Upper Volta and Chad—the rains have failed.

An embarrassment for the governments of these impoverished nations and a matter overlooked by a world with more noisome troubles, drought has silently crept into the lives of at least 30 million Africans. Nor are the troubles confined to Africa. Drought has almost circled the globe. Huge hungry mobs have rioted in rainless areas of India; a combination of drought and floods has crippled food production in Bangladesh, Sri Lanka (formerly Ceylon) and many parts of Southeast Asia. The Philippines, this last year, produced 740,000 tons less rice than expected.

The miracle grains of the much vaunted Green Revolution—already under attack as oversold—cannot perform the ultimate miracle: They cannot grow without water. In the United States the labyrinths of diplomacy and economics have led to the exhaustion of our historic food surpluses. Just when most nations are living year by year, hand to mouth, drought has come to much of the Earth.

In West Africa the alarm was only recently sounded. Aid has begun to flow in along creaky and inadequate distribution channels and shaky statistics have begun to flow out: Of the nearly three million head of cattle in Upper Volta, only an estimated 500,000 remain; the human population of Mauritania's capital, Nouakchott, is now 120,000, swollen to three times its normal size as nomads drift in from the hinterlands to wait stoically for handouts; in parts of the region the desert itself is moving south at a rate of 30 miles a year.

But statistics, like meteorological terms, are dry and remote. They smack of reports and evoke a distant sympathy at best. Drought, however, is an intimate, personal disaster and this is what photographer Farrell Grehan documented along the northern banks of the Senegal River, normally Mauritania's greenest area.

As he set out from Nouakchott to the small river town of Rosso late last spring, Grehan looked for dead cattle along the road. "We did not wait long. Flies covered the carcasses of cows, donkeys, goats and even camels. Excited and appalled, I kept taking the same kind of picture. Getting the best angle placed me to leeward as well as to windward of the carcasses. I had to gulp for air, hold my breath, focus on the hollow eyes with eyelashes of blue flies and then do it all over again from a different angle."

In recent years, immunization campaigns and newly dug water holes permitted the herds to increase. The resulting overgrazing was then compounded by the failure of the rains. Forage began to disappear. Water holes began to dry up. Livestock began dying and the nomads moved their dwindling herds southward. More than 35 percent of Mauritania's cattle have died; some 40 percent have been moved to Mali and Senegal

Near the Senegal River: grassland without grass, villagers without homes, and the carcasses of cattle.

Farrell Grehan's photographs have been the basis of SMITHSONIAN *articles on the wetlands of New Jersey and the dams of the Dutch Delta Project.*

With forage supplies gone, goats devour the foliage of trees, giving the advancing desert an assist.

and farther south, straining the resources of these already straitened countries.

"I approached a herd of a dozen cattle resting motionless on the ground," wrote Grehan. "Finally they started to rise, moving one limb at a time agonizingly. It was as if a dignitary paid an unexpected visit to an old people's home; everyone tried to get up but no one could summon the strength. Later, in Boghé on the banks of the Senegal River, I saw two cows chewing with intensity and concentration. One was attempting to eat a corrugated cardboard box, the other a burlap bag, all in dreadful slow motion. Only once did I see an animal being fed. It was a scrawny horse that must have been famished but it too munched mechanically like a children's toy winding down."

Unlike a toy that winds down, the conditions of drought tend to be self-perpetuating. The soil dries up, the surface grows hotter and the relative humidity therefore is lower, impeding cloud formation. Furthermore, for whatever moisture there is in the atmosphere to condense into clouds, "condensation nuclei" are needed—small particles given up to the atmosphere by the land's surface. In drought-ridden West Africa the land offers only dust, such tiny particles of dust that even when water does condense on them they do not grow heavy enough to fall from the sky.

Grehan was overtaken by a dust storm on the road from Rosso to Boghé. "In many places," he wrote, "windblown dust covered everything. It stung the eyes, filtered through clothes, covered the body's pores and daubed every black, brown or white man the same dun-colored yellow. Here were grasslands without a blade of grass: once fertile soil flung into the air, extinguishing the African sun."

And so the drought continues. Throughout the desert, thousands of herdsmen have tried to save their livestock by feeding them the foliage from the desert's trees. With trees cut down and shrubs devoured, there is little vegetation to keep the soil in place. Thus the desert grows. Creating its own weather, pushed by overgrazing and impelled by the actions of desperate men, the Sahara continues south as it has for centuries—but at an accelerated pace. It has leapfrogged the Senegal River, once a natural barrier.

In yet another way the drought feeds upon itself. In many areas, the drought prevented farmers from planting this year's crops; in other areas, harvest fell short. Having little or no food reserves, the farmers have been driven to eat their crop seed, thus eliminating the possibility of planting next year's crops.

"While livestock deaths are appalling," reported Jerry E. Rosenthal of the U.S. Agency for International Development, "crop losses throughout the Sahelian Zone are no less devastating. Grain production . . . has dropped 50 percent in many areas of the region. And in Mederdra, Mauritania, the fields which

Caught in a dust storm, nomads move the remnants of a herd south to seek food and water near the towns.

can be cultivated grow smaller each year as desert sand takes over. A forlorn village chief says: 'I am witnessing the burial of my village.' "

The desert grows, the crops fail and villages are abandoned—how many no one knows. Grehan spent time in one such deserted place: "Only the bare skeleton of the village was standing, a few wooden bowls and a ladle or two left behind, giving rise to the question of whether the people departed in great haste or had hopes of returning one day. Where could they go? To Mali? Senegal? Presumably those ravaged lands cannot be too happy about adding outsiders' problems to their own. Can these tribesmen find any land in all of West Africa which could possibly support them?"

The answer seems to be no. No place could support all of them. They flock to the towns and cities and to the rivers, seeking water, food and medical help. Jerry Rosenthal reported that Timbuktu's harbor on the Niger River has dried up to the point that barges can no longer reach the city. But there is water in the river and the nomads, whose families have always eaten meat and milk, wait hours in the 120-degree heat for a handful of grain.

Like the Niger, the Senegal River, one of Africa's largest, has dwindled to a trickle. Grehan noted that "one could walk across the river and in most places the water would barely reach above one's knees." The diminished rivers teem with people, carrying on much as they would in normal times, hoping—cheerfully assuming—it would rain soon.

That the rivers were drying up, that the drought would be serious dawned on officials well over a year after it began. (Of the six Sahelian countries, four are listed euphemistically by the United Nations as "the least developed of the developing nations." In spite of high mortality, their populations are growing. Literacy averages about ten percent and communications, particularly in the desert areas, are limited to the point of virtual nonexistence.) Late in 1971, the Food and Agriculture Organization's early-warning system began issuing ominous reports about local rain and crop failures, and at about the same time AID personnel on the scene had begun to sound the alarm. In 1972 food shipments—for both livestock and humans—started to trickle in and several Sahelian countries inaugurated rural development programs and well-digging efforts. Not until the end of March of this year did the six countries declare their region a disaster area and make an all-out appeal for help.

By early June animal feed and seeds were being airlifted into the region under FAO auspices. (Not just any seeds will do. They must be adapted to the climate and other conditions of the area; optimally the seeds should come from the Sudan and other nearby countries but Sudanese surpluses were insufficient, so much of next year's crop may fail even if it does rain.) In the

United States various private organizations, including Operation Push headed by Jesse Jackson, began to make appeals for food, and AID, though strapped by national economy strictures, nonetheless committed $24 million for food grain (156,000 tons) and its transportation—theoretically enough to feed 11 million people a pound of food a day for one month. By mid-June American air transports were aiding in relief operations, along with planes from other nations, but late that month a grateful André Coulbary, Senegal's ambassador to the United States, publicly worried that the American grain, plus some 250,000 tons from other nations, would be too little and would arrive too late. Ironically, if the prayed-for rains do come, roads would be rendered impassable and the food could not be distributed. Even without rains large sections of the region, particularly in Upper Volta, are beyond the reach of trucks and planes.

The nightmare that haunts West Africa now is, of course, famine. Most of the frantic relief efforts that gained momentum over the summer were mounted simply to avoid the starvation of some six million people. And by mid-July, experts expected that by October ten million people would be threatened with starvation. By July there had been no deaths reported with starvation as the cause. But thousands had died—no one knew how many. Was it that a famine had begun and no one would admit it?

Famine is so horrendous a part of human experience that no one wants to think about it. Officials and experts are leery of using the word lest they fall into the hazard of crying wolf. Furthermore, health officials generally list deaths by their final, specific cause rather than record a generalized condition, such as malnutrition, that may lead to a specific disease. But if widespread malnutrition resulting in death is famine, then there was famine in West Africa as early as last spring.

AID's Rosenthal reports that unknown numbers of children and old people are dying of measles and other diseases to which their underfed systems have little or no resistance. And of course what would be a minor threat in a highly developed country can be a disaster elsewhere: Medical facilities in the impoverished Sahelian Zone are minimal.

Farrell Grehan watched people lining up outside the offices of Boghé's only clinic. Operated by Algerians, it was indeed the only clinic for hundreds of miles around. "Two camels loped into the courtyard's center and were made to settle down on the ground. I watched the elegance of the animals and the delicate movements of the nomads as they loosened a small bundle from the first camel's back and carefully lowered it to the ground.

"It turned out to contain a very tiny, very lovely young woman, heavy silver jewelry making her frail arms seem even frailer. She had a baby with her. The nomads carried her in to the doctor's office where he applied a stethoscope and made his diagnosis. His assistant gave her shots and, since there were no hospital facilities, she was put on the bare floor in the end of the clinic where two young men and an old woman already lay with the look of death in their eyes.

"During the second night, the tiny woman died. The next morning I saw her child sitting alone in the clinic so covered with flies around his mouth and chin that he appeared to have a beard."

Prophecies and hard questions

As the summer drew to an end without rain, the immediate question was: How many more people will die, will there be a full-scale famine despite the best efforts of the world to head it off? Beyond that—once the drought ended—lay some further hard questions and some awful knowledge. It was known, for example, that thousands, probably millions, of young Africans would grow up blighted in their infancy by malnutrition, retarded in mind and body. It was known also that it would take at least three to four years for a tribe that had lost its livestock to build up a herd and regain self-sufficiency.

Would the tribesmen settle for smaller herds made up of better cattle (if indeed that could be arranged), thus perhaps avoiding the overgrazing that, even without a drought, had been destroying the land? Where would the money, the energy and the expertise come from to make better use of the region's rivers for irrigation and to find dependable sources of underground water? How would these destitute countries raise taxes, increase literacy rates, train and deploy medical personnel, control their population growth?

And amid all these questions one other seemed worth pondering. About ten years ago a number of scholars predicted darkly that given the size and present rate of growth of the population, the human race would inevitably experience a series of severe famines and social and political disruptions. Some ventured to say that the troubles would begin in earnest as early as 1975. So as the summer of 1973 ended and thousands of hungry Africans meditated on the outskirts of dusty villages and what seemed like a number of unrelated crop failures, dry spells and floods plagued the midriff of the planet, one wondered if the prophecies of those quickly dismissed as Neo-Malthusian alarmists should not now be reconsidered.

Orphaned by the death of his mother, an infant sits ignored except by flies in a village clinic.

Normally, ocean-going vessels could navigate past this section of the Senegal, one of Africa's largest rivers. It still teems with human activity, but one can now wade across and the desert has leaped it as well.

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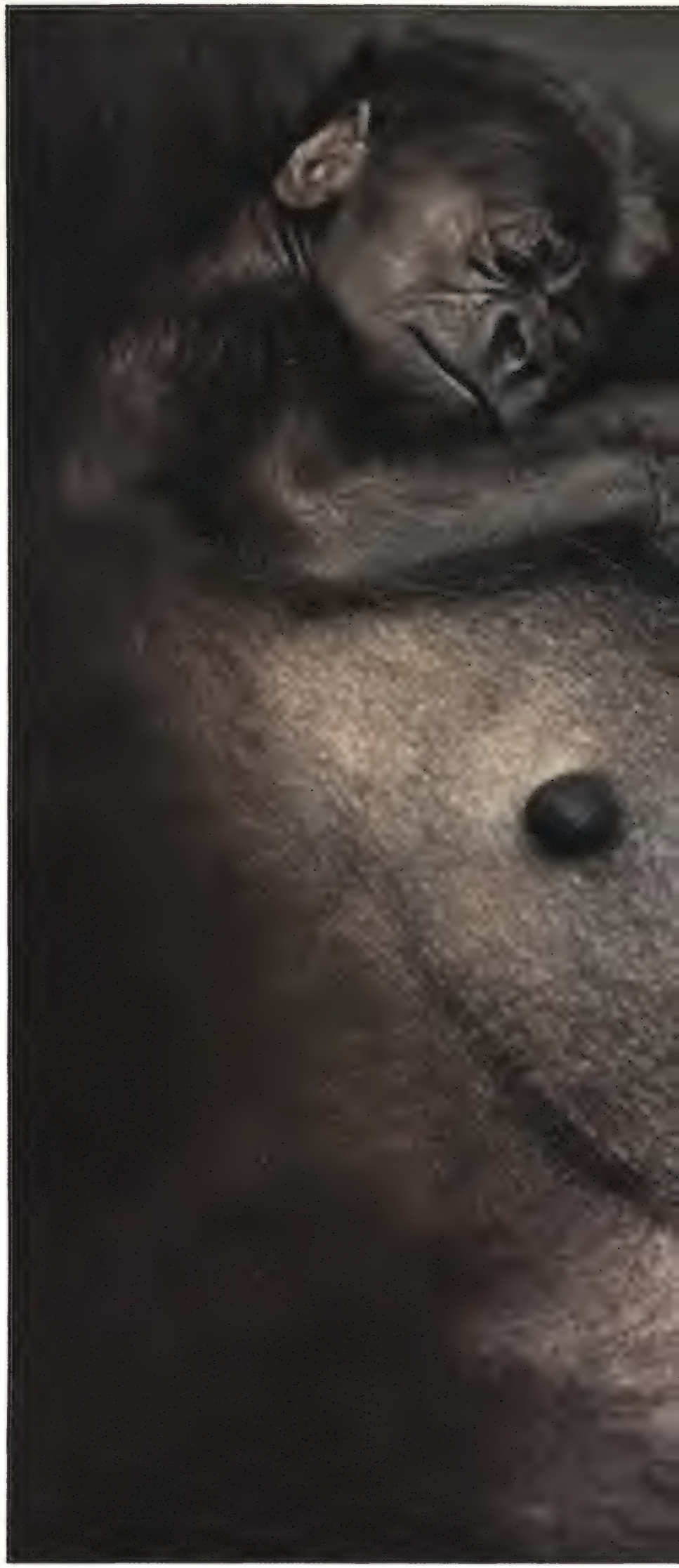
By Maxine A. Rock

It's not so easy to become a good gorilla mother

Current studies of sex, birth and child-rearing among captives of this endangered species may help to shed light on human affairs as well



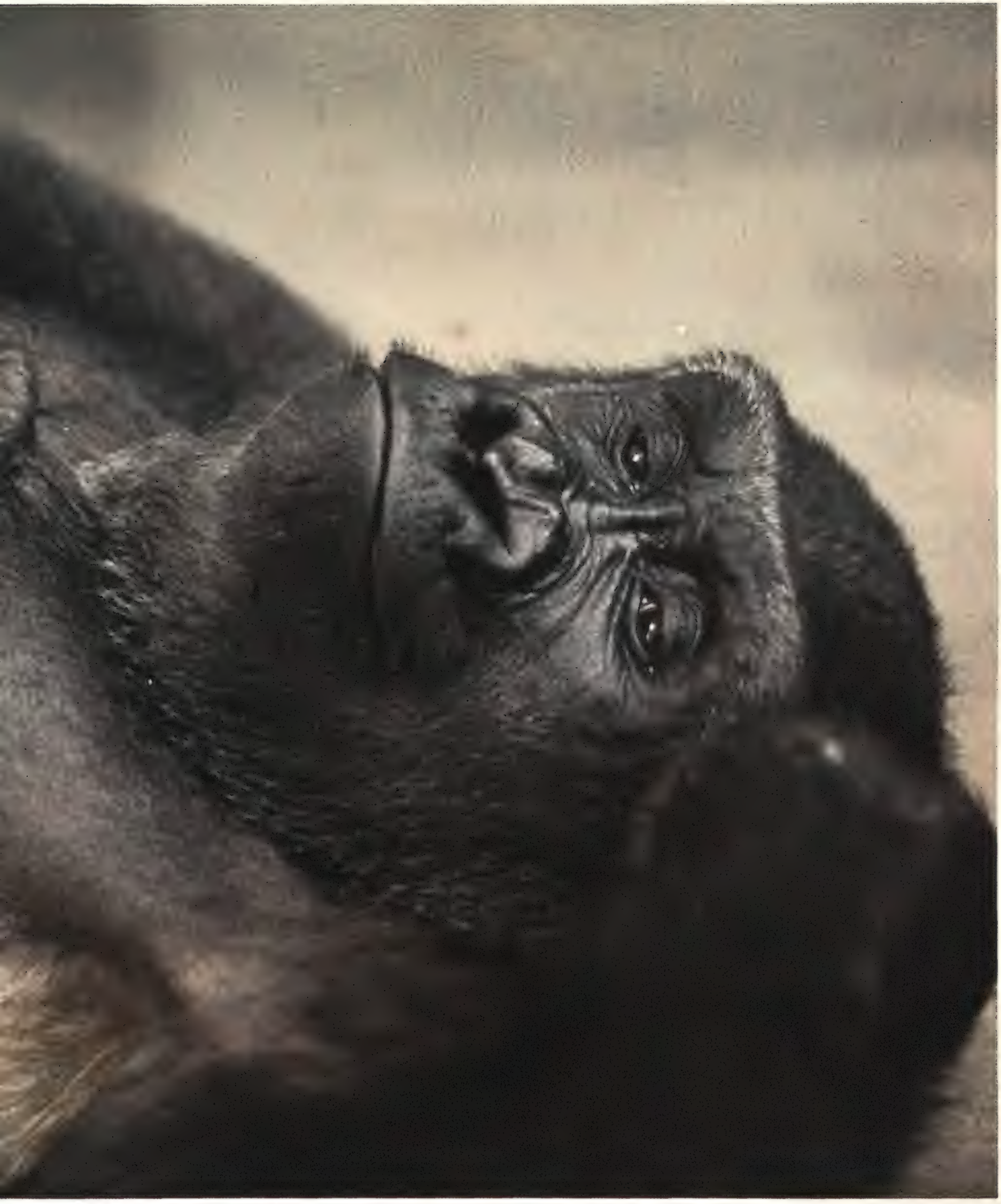
Shortly after Paki gave birth to a female, Kishina, at the Yerkes Regional Primate Research Center

At 9:30 on a hot, muggy Georgia night, a yellow sports car sped up the driveway of the Yerkes Regional Primate Research Center in Atlanta and was hurriedly parked. A bearded young scientist, Dr. Ronald D. Nadler, got out and rushed inside, heading for a special maternity cage in the large animal wing where a massive female gorilla rolled and grimaced in labor. She squatted, then stood, then crouched down on her elbows and knees. On her haunches, she waddled restlessly from one side of the cage to the other. She lay down and strained, then rose and squatted again. Her mouth opened, but no sound came out.

At 11:35 the gorilla suddenly stopped pacing back and forth, and reached back to her vulva. She made a tearing motion and tea-colored amniotic fluid spilled on to the concrete floor of the cage. Flanked by veterinarians, Nadler watched intently.

At 11:55 the gorilla sank to her knees near the front of the cage and the round, wet head of the baby appeared. There was a burst of blood and fluid, and the baby was on the floor. It gasped, then whined, and its mother responded with a deep growl. Nadler smiled and sighed with relief. It was the first gorilla birth at the Yerkes Center and one of only about 70 gorilla births in captivity in the world.

The Yerkes Center is one of seven major, federally funded primate research laboratories in the nation and houses about 962 monkeys, but the pride of Yerkes is its 98 chimpanzees, 40 orangutans and, best of all, the largest group of captive lowland gorillas in the



in Atlanta, she grasped her firstborn to her chest and both fell asleep on the floor of the cage. After birth, hormone changes in the mother may cause her normally gray-black hair to turn reddish brown.

To be a gorilla mother

world: 16 in all, including the newborn. The Yerkes Center came into existence 44 years ago in Orange Park, Florida, where Dr. Robert M. Yerkes, a prescient professor of psychology at Yale University, built up a colony of some 40 chimpanzees, partly because he was convinced that "in its sexual and reproductive life this anthropoid is sufficiently manlike, amidst experimentally advantageous differences, to render it particularly useful as a substitute for man in many types of inquiry."

Yerkes died in 1956. By 1965 the federal government had taken over the laboratories and the animals, moved everything to Atlanta (where the center began its association with Emory University), and begun to tap the center's wealth of biological information for use in the nation's space program, in medical research and for application to many human neurological and psychiatric problems.

Nadler, a slender, bushy-haired man who usually carries an elaborately carved pipe clenched between his teeth, is studying the full sexual cycle of gorillas at Yerkes to determine how, and to what extent, hormonal factors influence basic behavioral functions. He began his vigil with the pregnant female, Paki, from the onset of her labor at 9:30 P.M. on August 7, 1972, and went home to get some sleep only after the mother and her infant seemed to be resting comfortably together, at 12:30 A.M. on August 8.

Nadler's detailed records of Paki's behavior are probably the only such records of a gorilla birth in the world today. In addition to the light they might shed on human affairs, Nadler's studies will provide one way of learning how to maintain gorillas in captivity to save the species from extinction.

Nobody is certain how many wild gorillas remain in the thick, wet tropical forests of Africa. George Schaller of the New York Zoological Society, who might be considered Nadler's counterpart in the field, thinks there may be "at least 5,000 but no more than 15,000" mountain gorillas *(Gorilla gorilla beringei)* left; he has not studied the taller, more slender lowland subspecies *(Gorilla gorilla gorilla)* which inhabits West Africa and is separated from its mountain cousins by about 650 air miles. (Virtually every gorilla in captivity, including those in Nadler's study, is a lowland animal and for the purposes of Nadler's work the two forms are presumed to be basically alike.)

When Kishina was two days old she was separated from her mother briefly for a physical examination.

Amiable and endangered

Gorillas are a peaceful lot, with what Schaller called independent, stoic, and aloof personalities. Acts of aggression in gorilla life are generally limited to a stare, an annoyed jerk of the head, or a bluff charge. Biting or wrestling as a means of defense is a last resort, even though a mature gorilla, for example, might vary from 250 to 400 pounds or more; height, standing on all fours in the characteristic gorilla pose of leaning on the knuckles of its front limbs, is from four to six feet. Females are usually smaller—but to human eyes they seem no less imposing.

In the wild, gorillas live in amiable bands consisting of a dominant male, three or four females, their infants and several juveniles. Extra adult males are common. They may tag along with the dominant male for several years, enjoying his company and his females, and then wander off to form families of their own. If it can avoid disease, a wild gorilla may easily pass its 25th birthday, barring an encounter with a meat-hungry native hunter, a farmer protecting his fruit orchard or a white trophy hunter. Before tran-

Mrs. Rock, formerly with the National Parks and Conservation Association, is a science writer and helped to found Atlanta's zoological society.

quilizers became popular, a common way to obtain a baby gorilla for zoo display or scientific research was to shoot its mother. With the increasing human population, the rising demand for gorillas to study and display at zoos, and the conversion of African bamboo forests to grazing land, the survival of the gorilla in the wild is in serious jeopardy.

"That's one reason why close observation of a gorilla birth, mother-infant interaction and gorilla maturation is so critical," said Nadler. "We want to discover how to raise the socially adapted gorilla; we want to find out what conditions and experiences make it possible for a gorilla to become a good mother."

Paki, the gorilla which gave birth at Yerkes, was "a good mother" for one week. She nursed and cared for her baby, a female named Kishina, and kept the four-pound infant almost constantly enveloped in her giant arms. But one day one of the gorilla attendants noticed that Paki was becoming restless. She paced the floor, dangling the infant by one hand, while Kishina screamed in fear.

Kishina rejected

At Nadler's suggestion, two of Paki's favorite handlers came to keep her company. Paki responded by once again holding Kishina and mothering her. But when the handlers left, the gorilla's restless behavior resumed and another female gorilla was brought to the adjoining cage. "I thought the companionship of another familiar animal would make Paki more comfortable," said Nadler, but soon she showed new signs of restlessness and rejection of Kishina.

Nadler requested that she be put among the other gorillas with which she had been reared. There, she responded by resuming a show of motherly affection. But about four days later Paki seemed to be mistreating Kishina again, and this time Yerkes veterinarians removed the infant from her mother's cage. That move determined Kishina's fate: She would have to be hand-reared in the Yerkes great-ape nursery.

"Chimpanzees raised in social isolation, for example, are very strange creatures," says Nadler. "All you have to do to make a chimp neurotic, it seems, is to take it away from its mother. But all the gorillas we have here at Yerkes were orphaned at an early age and they are sociable. They copulate, we know they can breed, and they take care of their young—at least for a while. So early isolation from other adult gorillas in itself doesn't seem to cause problems in sexual performance or in some other forms of social interaction.

"But my educated guess about Kishina," Nadler continued, "is that *she* will be handicapped both in sexual and maternal behavior. She is different from Paki because she had only a week with her mother. Paki had more than a year. And Paki was raised with other young captive gorillas. Unfortunately, we don't have any other baby gorillas with which we can raise Kishina. The best we can do is let her stay with other apes, like orangutans and chimpanzees.

"It will be at least six years before Kishina is ready to copulate and get pregnant. By that time, I hope to have a small group of gorillas with varying amounts of maternal exposure. Then I can see how the separated animals act in comparison with the ones which stayed with their mothers."

In the auspicious first days of being a mother, Paki nurses her infant, but togetherness lasted only a week.

To be a gorilla mother

Wild gorillas are devoted mothers. They feed, transport and protect their young for several years after birth. Gorilla infants appear to nurse exclusively until the age of about three months. Then they take some bits of solid food and are usually completely weaned by eight or nine months. At about the same time they sample solid foods, they also begin crawling. They walk and can climb trees by themselves at seven months. At three years of age wild gorillas are on their own in the group; until then they seldom stray from their mothers' sides. But even after they achieve independence, the young frequently visit their mothers to eat or rest near them, drinking in added emotional support even though the mother may already have another infant in her arms.

Paki is now liberated from the duties of motherhood at Yerkes. Her daughter Kishina is still in the nursery, romping in a playpen with another young ape. They are not the only captive gorilla mother-infant pair to be separated. According to Nadler, it is more common for captive gorilla mothers and their offspring to be separated than for them to be left together. Gorillas are rare and very valuable animals and nobody wants to take a chance on keeping an infant gorilla with its mother if the mother seems at all nervous at first.

New York's Central Park Zoo, however, had a baby gorilla living happily with its mother and father until it suffered a broken arm and had to be taken away. It has since been reunited with its mother. This example, plus a few other scattered reports of compatible captive mother-infant gorilla pairs, gives Nadler some reason to believe that Paki and the other female gorillas he is studying may yet turn out to be adequate parents. "Paki was with her own mother for only one year," Nadler pointed out, "yet she did provide adequate maternal care for her own offspring for at least a short period of time."

One of Nadler's most important observations so far involves the process of mating as opposed to childbearing and it confirms Schaller's observations: Female gorillas apparently initiate intercourse only during a time of sex skin swelling—presumably a time of elevated female hormone secretion and ovulation. Robert Yerkes' work with chimpanzees in the 1930s and 1940s disproved the belief that, unlike other mammals, all higher primates—apes and humans—had no estrus or "period of heat." Yerkes proposed that "both female chimps and female humans underwent estrus, or periodicity of sexual receptivity."

Gorillas, Nadler now declares, follow the same cyclic pattern. "At the moment, I'm depending on an external sign—the sex skin swelling—to indicate elevated secretion of female hormones and presumably ovulation," said Nadler. "Eventually, I hope to obtain daily samples of blood from the gorillas and determine quantitatively the animals' changing level of hormones throughout the cycle.

"It is held by most people that human sexual behavior is probably little influenced by hormones," said Nadler. "Most doctors would say that when you remove a woman's ovaries her sexual desire isn't affected. But on the basis of what I've seen, and in the light of past animal research, human sexual behavior—like that of chimps and gorillas—may be more influenced by hormones than previously suspected. The implications for humans are numerous. Knowledge of hormonal rhythms, or periodicity of sexual desire, could very well facilitate the sexual adjustment of married couples in trouble. It could change the way doctors treat women's problems. And it would help women on oral contraceptives know to what extent the hormonal alterations might influence their sexual desire, for better or worse.

"Of course any hypothesis about human behavior must ultimately be tested with humans," Nadler admitted, "but perhaps we might get some ideas from watching gorillas that would not be readily picked up by students of human behavior. There are so many variables in human behavior, human lives are so complicated that it's hard to get reliable answers from humans about anything." On the other hand, chimps and gorillas have roughly the same menstrual cycle and period of gestation as human females. Their lives, which can be experimentally controlled, are infinitely simpler, Nadler pointed out, and they are infinitely more honest.

At ten months, Kishina and her orangutan cage-mate greet Dr. Ronald Nadler, who seeks to find out if Kishina can now grow up to be a good mother herself.

By Vine Deloria jr.

The tribe that was made to be fishermen

After nearly a century of attempts to force them to cultivate land, the Lummi Indians returned to the water; now they farm the sea

In the tidal flats of Lummi Bay, members of the tribe draw in a net full of silver salmon during their first

Less than half a decade ago the Lummi Indian tribe of Washington state was regarded as so backward that government agencies were advised to avoid them at all costs. Traditionally fishermen, the Lummis had been forced to become farmers, lumberjacks, factory workers, migrant laborers and craftsmen by the fluctuating federal policies which were designed in the nation's capital and imposed on Indians who were living 3,000 miles distant. During a century of this systematic oppression the Lummis persisted in the belief that God had meant them to be fishermen. Today they are not only happy fishermen, they may turn out to be among the world's best fishermen.

In an obscure bay in northern Washington, less than an hour's drive south from Vancouver, British Columbia, the Lummis have built an aquaculture project, a venture in the new science of sea farming. Already their discoveries about sea life and marine ecosystems have shattered concepts of several years' standing, and the eventual impact of the Indian fishery could be tremendously important for a world hard pressed to feed its increasing population.

The Lummi story goes back beyond the days of exploration of the Pacific Northwest. One of the Salish-speaking coastal tribes living along Puget Sound and the Straits of Georgia for more than a thousand years, the Lummis occupied a large area. They made an annual migration from the northern San Juan Islands, which separate Vancouver Island from the American mainland, to the area known today as Bellingham Bay, in Whatcom County, Washington. By following the annual spawning cycle of the various species of salmon, the Lummis early achieved great prosperity.

By 1855 settlement had reached the shores of the Pacific and the coastal tribes, in the familiar pattern of American history, were pressured to cede their ancestral lands in exchange for several small reservations and the guarantee of federal protection for their traditional fishing sites. The Lummis received four small tracts of land between the two branches of the Nooksack River. The reservation consisted of 12,000 acres of land that were heavily forested with Douglas fir and the adjoining tidelands covering some 5,000 acres which were exposed a few hours each day at low tide.

The first federal program to help the Lummis was the cutting of the timber to create farming lands. For a period of 40 years after the establishment of the reservation, a succession of Indian agents attempted to get the Lummis to farm their lands. But the Lummis regarded themselves as fishermen and,while they duti-

Author of Custer Died For Your Sins, *Mr. Deloria analyzed Lummi aquaculture in a program of the Smithsonian's Center for the Study of Man.*

harvest in 1972. Below right, the bounty: The fish are immediately cleaned and quick-frozen.

fully farmed, they always kept one eye on the river, waiting for a chance to return to the water.

By 1920 the farming activities on the reservation were almost totally conducted by non-Lummis and the Lummis had become dependent on rental income from their allotments. The rising cost of living began to cut deeply into the relative prosperity which the Lummis had managed to achieve over the years. In the 1890s the state of Washington had overridden the federal treaty rights of the Indians and licensed large companies to construct traps for catching salmon. Since the traditional fishing grounds had been at the best locations, state licensing meant a virtual confiscation. The Lummis lost six of their best sites and were forced to confine their fishing to the Nooksack River. The loss in income was severe but the Lummis somehow managed to survive.

By the first decade of the 20th century, affluent non-Indians were eyeing the prime shoreline of the Lummi reservation as well-suited for the location of summer cottages. The result was a series of lawsuits designed to wrest the tidelands from the tribe. Looking back on it today, one could only conclude that the Lummi aquaculture was preordained. The *Romaine* case in 1919

To close the sea-pond dikes involved a race against incoming tides. Dutch expert said an expensive

determined that the federal government had indeed intended to give the tidelands to the Lummis.

A little over a decade later, two cases were decided that explored the extent to which the tidelands were really tribal property. The *Stotts* case in 1930 involved the question of whether title to tidelands was sold when the Lummis had sold off some of their shore lands. Had the tribe lost the case the reservation would be only a memory. The court, however, pointed out that if the beach had been included in the shoreline allotments, the individual Indians receiving those allotments would have received lands far more valuable than the tracts further inland and, since it was the policy of the government to treat all Indians alike, there could be no intent to include tidelands in the shore allotments. They belonged to the whole tribe.

A year later in the *Boynton* case a question was raised with respect to the meander lines of the shoreline allotments. Were the lines on the original allotment map meant to indicate fixed property lines or a general line of shoreline meander which shifted as the shoreline changed? In a rather dramatic courtroom scene, the Lummi lineman for the original survey, now ancient and infirm, took the stand and with amazing accuracy recalled almost every incident in the surveying work done nearly half a century before. The court held that the lines shifted with the shoreline and that creation of tidelands by the action of the water did not give the property owner any tidelands title.

The importance of these three cases can hardly be overestimated. By 1968, when the tribe finally decided to attempt to develop an aquaculture, its sole property in land consisted of 5,000 acres of mud flats that were uncovered everyday by the tides. The Lummis had nothing else left. It was like building a dairy herd using only the distant moo of a cow.

Through the 1930s and '40s, the Lummis had continued to fish, supplementing their income with temporary jobs, and their fortunes rose and fell with the vitality of the fish runs. At one time as many as 20 Lummi fishing boats cruised the inland waters. Life was good. But by the middle 1950s the salmon runs had been reduced to a fraction of their postwar levels, prices for salmon had plummeted as more fishermen sought to keep their income high by increasing their catch, and the price of boats and equipment skyrocketed as fishermen sought ever more sophisticated gear. The Lummis were soon pushed aside by non-Indians with the capital to maintain the expensive fishing boats. A few Indians continued to do some gillnet fishing on the Nooksack River on a part-time basis, but the majority simply could not afford to fish.

During the 1950s the policy of the Bureau of Indian Affairs had been to relocate Indian people in the cities. By the end of the decade many Lummis were living in urban areas on the coast, and even a change in government policy to encourage the development of human resources did not affect them much. In 1963 the Bureau announced a master plan for the development of the Lummis and their reservation. Someone in the Portland Area Office of BIA must have had a rather quaint conception of economic reality. The massive economic development plan of the Bureau turned out to be the creation of a number of cottage industries that employed only the women of the tribe.

Relying on its extensive knowledge of Indians (the squaws do all the work and Indians are good with their hands), the Bureau made a $30,000 loan to the tribe and launched the Lummi Weavers; later projects were the Lummi Knitters and Lummi Arts and Crafts. The Bureau saw the future as one of unlimited profits through arts and crafts sales. Every Lummi was encouraged to weave, sew, knit, carve or do beadwork.

The projects lasted six years. By 1969 the tribe was

second dike was required, but the ingenious Lummis used plastic (above) and closed the gap.

$24,000 in debt; the best project had returned an average income of $1,000 a year to each participant. The first war on poverty on the Lummi reservation had ended in a complete defeat.

While the Lummis were reaping this magnificent economic harvest, a company made a serious offer to lease the tribe's tideland area and build a magnesium oxide plant. A mountain of green ore containing the magnesium would be delivered to the plant. It would then be reduced to the metal, leaving a massive heap of tailings and polluting the waters for miles. When this plan was presented in the tribal meeting by Lummis who favored the industrial development of the bay, the majority of the tribe withheld their support. They refused to sanction any plan which would permanently damage the bay upon which they had lived for so many years. Approval was postponed while the Lummis sought an alternative use for the bay.

Some Lummis had heard that it was possible to develop sea farming projects, so they sought out Wally Heath, a professor of marine biology at nearby Western Washington State College. Heath, a tall, engaging and astute man, had long been interested in the development of ecologically sound food production projects. And he knew something about Indians. While a graduate student at the University of Arizona, Heath had worked with the Papago Indians on desert ecology projects and he had come to appreciate and understand the Indian reverence for land. What was perhaps even more valuable to the Lummis, Heath was a consultant to the Oceanic Foundation which was developing similar projects in Hawaii.

Heath visited the reservation and talked with some of the elder Lummis who had registered strong opposition to the development of the magnesium plant. Almost to a man they voiced their opinions that the bay should be used to support life. They told Heath of the variety of sea life that flourished in the region before the coming of the white man and his destructive factories. Heath saw that the bay could easily support a large and varied seafood population which could be commercially developed and harvested. Before leaving, he informed the people that they had an excellent site for an aquafarm, but that only a total community effort could make such a project successful.

Support for the aquaculture developed quickly; among those who became strong advocates of the project were two men who were to assume responsibility for its eventual development—Vernon Lane and Sam Cagey. Both men were from families of long-standing prestige in the community. Each had at one time been a fisherman but had been forced to find other work when the salmon became scarce. Yet there were contrasts between the two men. Vernon Lane is quiet and serious while Sam tends to be boisterous and the center of attention wherever he is. Vernon would always patiently present the program, with Sam ever ready to "make them an offer they couldn't refuse."

In April of 1968 the tribal council finally voted to explore the possibility of building an aquafarm. That summer Heath and four young Lummis did a complete chart of the Lummi Bay area. They marked the currents, the water levels at certain times and the flow and extent of microorganisms which would be needed to feed the larger shellfish and salmon. By February 1969 the tribe had drawn up plans for a 4.4-acre research pond and presented the plan to the Office of Economic Opportunity and the Economic Development Administration. Both agencies were enthusiastic about the project. OEO made a grant of $300,000 for the research pond and EDA contributed $143,000. Shortly afterward the Manpower Development Training Agency gave the tribe $150,000 for a training program to teach tribal members to work in the pond.

A tribal obsession

A small oyster hatchery was built that summer and shellfish research began in July of 1969. Eighteen Lummis, some of whom had been in other educational programs, embarked on a course in marine biology so rigorous it would stagger the average college student. The Lummis could not have been more enthusiastic about the program. They built the research pond twice as fast as the most optimistic construction experts had anticipated. Aquaculture became almost a tribal obsession, with elderly Lummis sometimes coming to watch and return home to encourage their grandchildren to work at the project.

By summer of 1970 the research results were in. Donaldson trout grew to 10 times their original fingerling size in the concrete test ponds of the aquaculture and

almost 20 times their original size in the dirt sea ponds. In the short period from April to October silver salmon in the concrete ponds could be grown to market size. In the same period oysters grew from a quarter-inch to three-and-a-half inches. With hardly a pause, the Lummis knew they had a winner and began drawing up plans for a 175-acre pond for large-scale oyster and salmon production.

The EDA and OEO were also impressed with the spectacular results and once again supported the tribe with grants for construction of the larger pond. The Oceanic Foundation made some cash grants for the tribe to use to match the federal money, and in late July of 1970 the Lummis began to build the large pond. In November 1970, to prepare for the completion of the large pond, the tribe built a river pond on the Nooksack in which they began raising 300,000 rainbow trout. The Lummis had discovered how to convert freshwater trout to saltwater and reverse the process in a period just under three weeks without any significant loss of fish. Just how they do this is the most closely guarded secret of the aquaculture program.

Building the large pond was a monumental task in itself. The tribe scrimped and saved and purchased a tract of land from which sand, dirt and gravel were taken for the dike. Lummi men bought and leased gravel trucks and worked backbreaking hours, often at no pay, in order to save money and keep ahead of the construction schedule. June of 1971 was the target date for completion, a time when the changing tides would be least likely to destroy the dike.

As the arms of the dike extended across Lummi Bay and began to close, the most delicate problem of construction arose. The tides had an increasingly smaller area into which they could move as construction continued; the water rushed faster through the reduced opening, cutting deep channels. At a certain point in construction it would be an even contest between the dike-builders and the tide as to which could move the most material. The situation was not unique to dike-building but it was extremely serious.

An expert in closing dikes in Holland advised the tribe on the closing. His news was hardly encouraging. In Holland the practice was to build a large obstruction of willows and reeds to prevent the tide from tearing away the arms of the dike while it was being completed. The engineer estimated that it would cost $300,000 to close the dike using this method. There was, incidentally, no other method known for closing a dike and no one in the United States had ever attempted to close a dike of this size. The cost was totally beyond the reach of the tribe.

After consultation with their local construction company engineer, the Lummis took a spectacular gamble. Figuring that the tide could be useful as well as destructive, they sent workers out in front of the gap yet to be closed. The young Lummis fastened several acres of plastic sheeting over the tidal bottom. The incoming tide forced the plastic down against the bottom of the opening as it came in, thus holding the sand in place. The tribe had to close the final 1,000-foot gap in a mere 20 hours. They would not have had that much time were it not for the fact that the second "high" tide of the day never reaches the normal peak at that time of year. Working day and night the Lummis finished the task eight hours ahead of schedule at a total cost

Shellfish director Richard Poole (left) and George Lane, reflected in surface of an experimental tank, are expecting $2-million oyster crop by 1976.

of $30,000. There are now at least two ways to close a dike. The expensive way and the Lummi way.

In November of 1971 the Lummis began construction of a modern oyster hatchery and a month later started a new fish hatchery, completing both in 1972. The large pond presently has 20 million oysters growing on plastic trays, with a mature market value of $1 million; they estimate that by 1976 they will have a program producing an income of $2 million annually in oysters alone.

The river fish hatchery, besides allowing for conversion and reconversion of fish between fresh and salt water, can produce between 5 and 10 million fingerlings a year. The tribe now estimates that 2 million fish eggs can be hatched every two months and that they will concentrate on four species: silver salmon and trout, which will be essentially pond-reared, and other varieties of salmon and steelhead (a sea-run rainbow trout), which will be used to replenish the stock of the Nooksack River, making it one of the most productive fish rivers in the Pacific Northwest.

Other tribes ask Lummis for advice

At full capacity more than 200 Lummis will be working in various phases of aquaculture, and more than 100 have already been trained in the operations of the hatcheries through a Manpower Development Training grant. The training program has been so successful that some 20 tribes from across the nation have asked the Lummis to set up an ecological training center for adaptation of Lummi techniques to other areas and problems.

The most spectacular part of the Lummi story is the impact the project has had on the people. Many Lummis have moved back to the reservation. The aquafarm provides the first continuing payroll the reservation has ever enjoyed, helping to give Lummi families enough income to qualify for decent housing. Young Lummis working on the project already know as much as the average fish biologist and are intent on learning even more about sea life. The older people are happy that the tribe has finally regained its rightful place among the fishermen of the world.

In a way, perhaps, the original government proposal to make the Lummis into farmers has been accomplished, for they are hard at work farming the tidelands. They have reached the ultimate state of sophisticated farming; they now can grow either salmon or trout to fit the size of any frying pan you can buy, and plans are going forward to market a Lummi label brand of seafood. You may soon be pricing salmon, oysters and trout and discovering that they are competitive with other foods. Look at the label. You just might see a Lummi smiling at you. Smile back.

In addition to fish, the Lummi aquaculturists also raise oysters. Here oyster shells are being washed.

A tribal worker inspects hatchery rearing tanks, each of which contains 50 thousand fish fry.

Raised specially by a method the Lummis keep secret,
young fish pour into pond from a spout on a bridge.

L'Heure Bleue - 1913

Mitsouko - 1921

Shalimar - 1925

Vol de Nuit - 1933

Chamade - 1970

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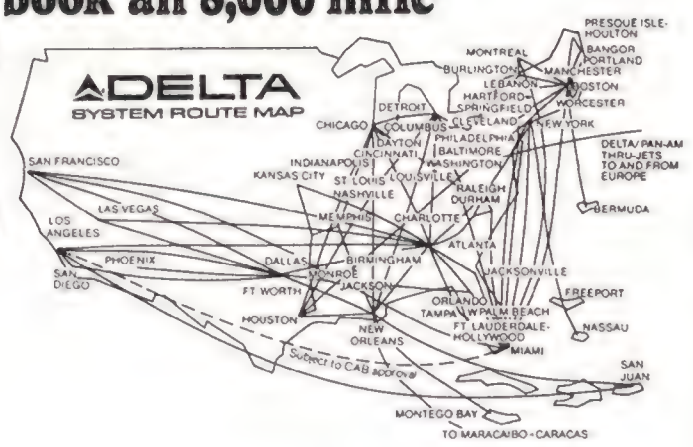

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Book reviews

The Making of the President—1972
Theodore H. White
(Atheneum, $10)

On election morning 1972, Air Force One lifted off from El Toro Marine Base in California. The President had made his last public appearance as a candidate the Saturday before in Ontario, the same California town where his political climb had begun 27 years before.

Now Richard Nixon was heading back to Washington and the victory celebration for a campaign that had been all but over three months before.

Theodore H. White sat in the tail compartment of Air Force One, intent on capturing the mood of this last day for his current quadrennial campaign history. A half-hour before landing at Andrews Air Force Base, White was summoned forward for his private interview with the President. It was one of several meetings White had with the President during and after the 1972 campaign.

Most of the White House press corps had gone through four years without ever being alone in the same room with Richard Nixon. For some, contact had been so minimal that they were hard pressed to tell an anecdote about the man.

White, however, could tell plenty of Nixon anecdotes. The President returns the author's phone calls. And White has even been to the President's private hideaway in the Executive Office Building to see Mr. Nixon's Asian mementos.

The author enjoys access to political figures of every stripe. The politicos try out their jokes on him and share confidences. For White is not interested in spot news—the delicate issues of the moment

that could cause a candidate embarrassment in tomorrow's headlines. He writes a view of recent history, not news.

White's conversations with political leaders reflect his search for the overall mood of the candidate, the campaign and the candidate's perception of the electorate. He asks how they use their time, delegate responsibility and tackle issues. Together, they chew over the symbolism needed to sway the electorate. White's book reflects the philosophy of the men and the times, not necessarily the nuts and bolts of the campaign.

On March 17, 1973, White met with the President for two-and-a-half hours. The discussion ranged from the appointment of a representative to China to the efficient use of time. White could see no reason to ask the President for his view of the gathering storm over Watergate. (His own view is that Richard Nixon is, "at best . . . guilty of gross negligence.")

The Making of the President—1972 is, then, a very personal history of a Presidential campaign. White is at his best in the description of Thomas Eagleton's purge from the Democratic ticket and in a chapter on the President's relationship with the media.

The reader will find the book thought-provoking and lucidly written, although it is not, obviously, the full history of how this President was made. At this writing that judgment is still to come.

—*Stephen Green*

Press aide to U.S. Senator Alan Cranston and a former Washington newsman

The Age of Arthur
John Morris
(Scribner's, $17.50)

The history of the British Isles is falsified if dated from 1066 and all that, with only a backward glance at a "Dark Age" that separated the story of these western islands from their earlier, 400-year-long history as part of the Roman empire. The age of Arthur—as distinctive a period as the age of the Plantagenets or the Victorian era—is the period in which Britain had its beginnings.

These beginnings are discernible only in bits and pieces. But for some decades, the so-called Dark Age has been getting lighter, thanks to contemporary archaeology and scholarship. Mr. Morris, a senior lecturer in ancient history at University

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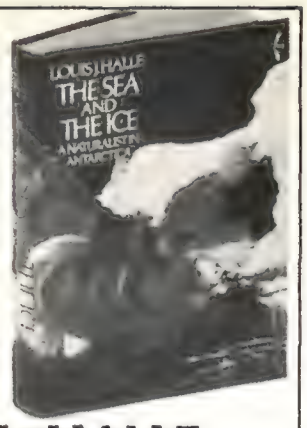

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College, London, has been long regarded as a ranking specialist in Dark Age dating. This present major work collects his observations and analyses of the multiple sources from which the shape of Arthurian England appears in broad outline: annals and chronicles, genealogies, lives of saints, literature, archaeological digs, artifacts and place names. By year's end, a companion volume, *Arthurian Sources* (Phillimore, Chichester), will be available, presenting in detail material underlying the conclusions more briefly and categorically expressed in *The Age of Arthur.*

King Arthur as portrayed by N. C. Wyeth

Although the version now at hand is weightily documented, some of Mr. Morris's inferences will be challenged. For instance, he firmly places the battle of Badon (c. 495)—Arthur's crucial victory—on Solsbury Hill just east of Bath; the terrain is almost perfectly suited to a devastating breakout by besieged cavalry, charging downhill into ranks of foot-slogging Saxons. But other historians will champion more central sites such as Liddington at the Swindon Gap in the Thames valley, or Badbury Rings further south, and some will say that the whole sequence of Arthurian battles occurred on the Scottish border.

The victory at Badon repulsed the Germanic invaders decisively. For a generation thereafter, until Arthur's death at the battle of Camlann (c. 515), the central area of the island enjoyed the period of order and justice that gave rise to one of the great legends of the Western World. After victory came failure: civil war, anarchy and wave upon wave of conquest by northern Europeans.

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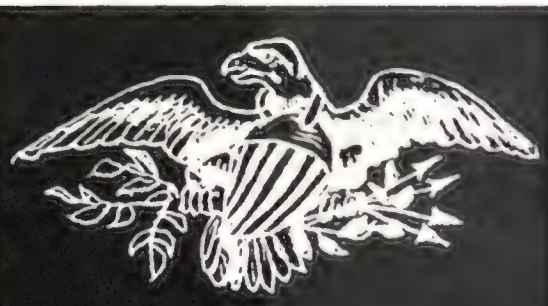

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"Arthur dominates and unites the history of two centuries," Morris states; "his victory was the climax and consummation of the fifth-century struggles; and his undoing shaped the history of the sixth century. . . . Yet even the barest outline of who he was and what he did must be inferred from dubious uncertain hints. There is just enough to show that Arthur existed, and was honoured in the next few generations as the greatest general and ruler of the recent past. . . ."
—*Helen Hill Miller*
Author of *The Realms of Arthur*

The View from Hawk Mountain
Michael Harwood
(Scribner's, $6.95)

Hawk Mountain, Pennsylvania, an increasingly popular mecca for bird watchers, played host to 35,000 last year, most of them during the fall months. Among the visitors of an earlier year was the author of this book. He returned again and again, charmed by the hawks drifting south overhead, the blazing colors of autumn on the mountain, and the picturesque old-timers of the towns below.

Now, in a relaxed and somewhat rambling manner, Mr. Harwood has written of what Hawk Mountain and the entire region mean to him. The staff of the sanctuary are his friends, and he tells of their backgrounds and activities. Then he discusses the birds; the 15 or so species of raptors that pass along the Kittatiny Ridge from late August to early December on their way to more clement wintering grounds. Though not a naturalist, the author is usually careful with his facts.

Mr. Harwood has no ax to grind. Yet his discussion of long-lived pesticides leaves no doubt that they are responsible for the decline of the peregrine falcon and other species, and that improvement may be expected if the use of such chemicals is curbed. Again, in telling of falconry, no hard-and-fast stand is taken, but the conclusion seems to me inescapable that the peregrine, in particular, must not be used for that purpose unless or until its numbers increase.

At the several recent conferences on birds of prey mentioned by Mr. Harwood, input from the Hawk Mountain Sanctuary Association has been minimal or nonexistent. Undoubtedly, the staff is too busy, but it should be easy to provide or

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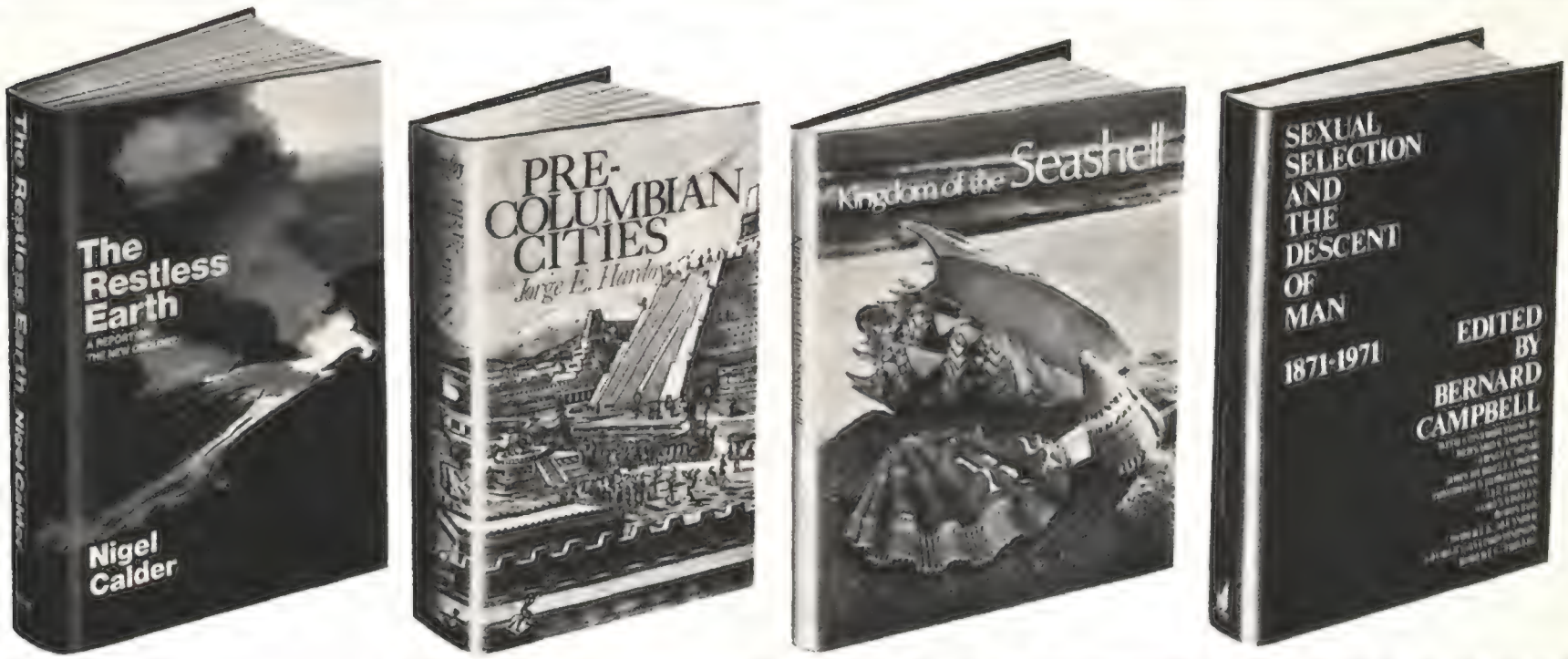

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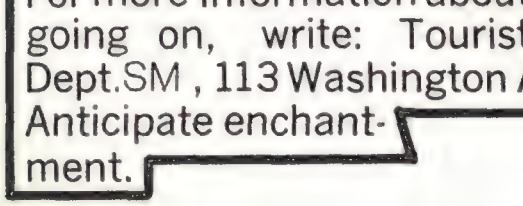
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raise funds for a postdoctoral fellowship. Data are at hand that need analysis; Association Director Joseph Taylor and Curator Alex Nagy, among others, have made interesting observations and speculations that should be followed up. It is gratifying to learn that the new headquarters will free the old one, to some extent, for the use of scientists.

The View from Hawk Mountain is entertaining, and will take its place beside the earlier *Hawks Aloft* by retired Hawk Mountain curator Maurice Broun.

—Dean Amadon
Lamont Curator of Birds, The American Museum of Natural History

The Living Presidency
Emmet John Hughes
(Coward, McCann & Geoghegan, $10.95)

"The executive power shall be vested in a President of the United States of America. He shall hold his office during the term of four years. . . ." Following that, the Constitution becomes less specific about what the powers of the Presidency really are. Consequently, every President from George Washington through Richard Nixon has interpreted the ambiguities of his powers according to his own personality and style.

That is the provocative thesis of Mr. Hughes, who is Professor of Politics at Rutgers University where he teaches a graduate course on the Presidency. Portions of this book were adapted from a two-part article that appeared in SMITHSONIAN in March and April 1972.

Log of the Molly Brown
Richard Zantzinger
(Westover Publishing, $9.95)

One spring day in 1969 Richard Zantzinger walked away from a construction job, a failed marriage and an income tax debt. He set out around the world aboard a second-hand, 35-foot fiber glass sloop. Few of us have so little of Walter Mitty in our genes that we never dream of going and doing likewise. We'd do it, too, if the boss or the family or the feds crowded us much more, but. . . .

There were no "buts" for Zantzinger, once he made up his mind to go. He took a cram course in celestial navigation, bought a sextant and the necessary charts,

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added some wisely chosen mechanical and electronic gear, and installed a self-steering device activated by a wind vane. His first crew was his daughter and the young son of a friend, who helped sail the boat as far as Key West. From there onward, a succession of friends and acquaintances, most of them female, joined the ship's company and eventually left, usually under amusing circumstances.

Zantzinger is a darned good storyteller with an enviable ability to find adventure where others might be merely uncomfortable or suffer a loss of dignity. His book is not a technical treatise on blue-water sailing, although plenty of good ideas are expressed. However, anyone actually planning to follow in Zantzinger's wake should read more than *Log of the Molly Brown* before setting out.

But any Walter Mitty who can feel the surge of the great Pacific in the kids' wading pool will find enormous satisfaction in Zantzinger's yarn. The dawns and days and sunsets at sea, the whiskey and the women, the altercations with port authorities (always won), the characters met along the way, all are the stuff of wondrous daydreams. The ultimate satisfaction, though, is that Zantzinger did it.

—Thomas French Norton
Columnist for *Motor Boating & Sailing*

Flow East
A Look at Our North Atlantic Rivers
John M. Kauffmann
(McGraw-Hill, $7.95)

Do you have nostalgic memories of a babbling brook, of a rapid river or the pleasant sounds of flowing waters? Then author Kauffmann has written a book especially for you.

Our rivers of the North Atlantic region are described, extolled, lamented and pleaded for with compassion in a relaxed, narrative style. "Look at a river and the landscape it has created and you will discern, moreover, a graceful, reasonable design for living. . . . Along riverways we may gain serendipity, and perhaps quietly perceive who we are, how we fit in, and where we are going."

The wild beauty of clean, unspoiled rivers is narrated by a white-water canoe-and-fishing expert with words of love and praise for the fast-flowing waters he has experienced and enjoyed. However, the fate of many of our liquid highways is

also described in terms that make sickening reading. Chapters on "Zombies" (dead rivers) and "Damnation" provide a necessary background for the crusade heralded by the book. The destruction of many of our rivers caused by uncontrolled industrial and sewage pollution, river-land developments and subdivisions, superhighways and dams is lamented.

The theme of the book, obviously, is the movement to save rivers for all to enjoy. The stories of the Wild and Scenic River Act of 1968, the preservation of natural areas in national and state parks, private clubs and the effects of citizens' actions are told with authenticity. The Potomac seems to be a logical place to begin caring for rivers, but the plans to preserve it have been stymied by the problems of obtaining funds. The author states that the average amount of money spent for one mile of interstate highway could buy two miles of Potomac riverscape—and protect it for good!

There are now a few preserved rivers and several which have been cleaned up and saved, as well as plans for preservation or revival of many other rivers. This book will help readers be more effective in trying to improve our waterways.

"Take a child to a river; acquaint him with its wonder, its beauty, and its power; let him enter into the joy of running water, and it will not only be a playmate and playground, but a teacher and classroom as well."

—Dale W. Jenkins
Director, Ecology Program
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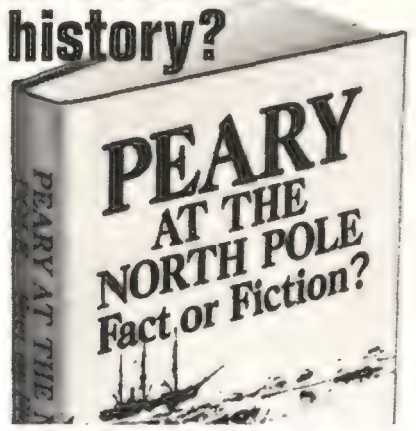

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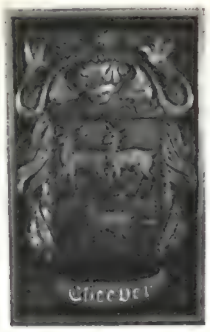

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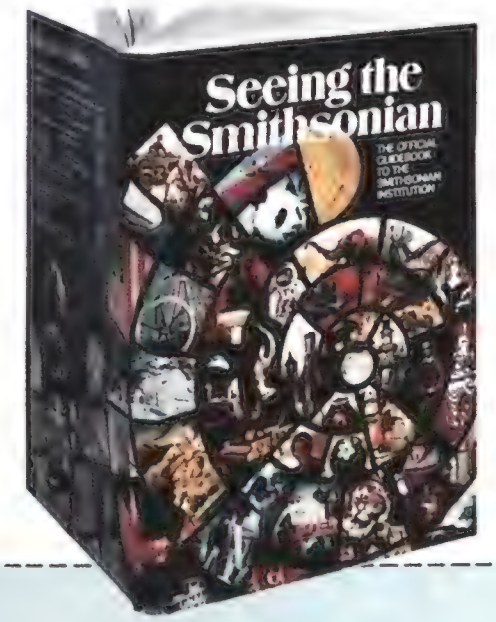

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Smithsonian highlights

Anacostia Neighborhood Museum
The Museum celebrates its sixth anniversary with the opening of a new exhibit, "Africa: Three Out of Many." Cultural and religious artifacts, including masks, manuscripts, crosses and textiles from Ethiopia, Ghana and Nigeria will be displayed in three separate African huts—opens September 15.

"The Challenge of the Neighborhood Museum" is a three-day series of panel discussions, seminars and lectures beginning September 21. The public is invited, but seating is limited. For information, call (202) 678-1200.

Freer Gallery of Art
"Chinese Figure Paintings" is the second of three shows planned to commemorate the 50th anniversary of the Freer Gallery. The exhibition consists of 59 Chinese paintings, ranging from the 10th to the 18th century. It is the first public showing of many of these items from the Freer collection—opens September 12.

"Turkish Art of the Ottoman Period" is a collection of miniature paintings, drawings, portraits, manuscript illuminations, bookbindings and ceramics. The exhibition commemorates the 50th anniversary of the Turkish Republic.

National Collection of Fine Arts
"The 23rd National Exhibition of Prints" consists of 73 graphic works chosen from over 400 prints entered by artists throughout the United States. NCFA, in conjunction with the Library of Congress, sponsors this competition annually—opens September 24.

Smithsonian Speakers

The National Speakers Bureau is a service provided by Smithsonian Associates which offers an opportunity for organizations within the United States to request curators and other Smithsonian staff members to lecture on a wide spectrum of disciplines. Travel and other expenses are paid by participating organizations. Write: National Speakers Bureau, Smithsonian Associates, Smithsonian Institution, SI 118, Washington, D.C. 20560.

National Portrait Gallery

"The Black Presence in the Era of the American Revolution, 1770-1800" is a major exhibition of 250 items, including portraits, prints, broadsides, petitions, poems and letters which demonstrate the influence of blacks in the founding of this country (see August SMITHSONIAN).

Renwick Gallery

"Form and Fire: Natzler Ceramics 1939-1972" is a collection of 100 pieces by Gertrud and Otto Natzler, who are known for the combination of simplicity and perfection in their ceramics.

Associates' Events

Guided tours of The Francis Henry du Pont Winterthur Museum near Wilmington, Delaware, are offered September 8 and 15. Other events include a performance by noted avant-garde composer John Cage; fossil hunts in the Shenandoah Valley; and a two-day trip to Wallops Island, Virginia. For information on Associates' events, call (202) 381-5157.

Parking on the Mall

Metro construction has made parking on the Mall near the Smithsonian complex extremely difficult. All parking prior to 10 A.M. is restricted. The use of fringe parking areas and/or public transportation is recommended whenever possible. Current parking information may be obtained by writing to the Smithsonian Associates' Reception Center.

Smithsonian Commons

Luncheon facilities for members of the Smithsonian Associates are in the original Smithsonian Building. Open Monday through Friday from 11:30 A.M. to 2 P.M., the Commons offers a buffet luncheon from $1.40 to $1.85.

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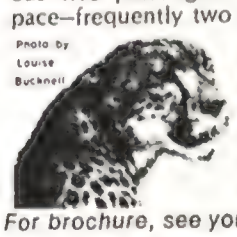

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Travel the Smithsonian way

One of the benefits of being a Smithsonian Associate is the opportunity to participate in Foreign and Domestic Study Tours, led by Smithsonian Institution curators or other experts. These specialized, quality tours offer a combination of study, vacation, discovery and adventure to Associates and their families.

FOREIGN STUDY TOURS

Come aboard the spacious yacht *Argonaut,* chartered especially for Smithsonian Associates. Some of the world's great scholars, such as Sir Kenneth Clark, are leading cruises in 1973-74. Two cruises and six other Foreign Study Tours are still available.

Sites of Civilization Cruise: From Rome to Athens, via Sicily, Malta, Tunisia, Egypt, Thera and Cyprus—April 6-27, 1974.

Black Sea Cruise: Depart and return Athens, via Turkey, Bulgaria, Romania and Russia—September 17-October 6, 1974.

Copernicus' Poland and Italy: In this 500th anniversary year of Copernicus' birth, visit the scenes of his life in Krakow, Frombork, Torun, Warsaw, Bologna and Padua—October 1-21.

West Africa: Historic sites from Mali to Senegal—January 8-February 1, 1974.

India and Nepal: Emphasis on architecture and museums—January 22-February 15, 1974.

Greece: Sites and flowers in northern Greece and the Peloponnesus—April 27-May 12, 1974.

Ethiopia and Kenya: Ancient and contemporary cultures from Aksum to Lalibela, plus several days in Kenya—May 23-June 14, 1974.

Afghanistan and Pakistan: Archaeological and historical sites—October 21-November 11, 1974.

DOMESTIC STUDY TOURS

Skylab Launch: View the launch of Skylab 4; tour NASA facilities at Cape Kennedy—late October.

Sea and Shore Laboratory, Charlotte Harbor, Florida: Using the facilities of Mote Marine Lab, participate in current research problems; discover the low-tide shore life; cook out on an uninhabited island—October 11-18.

Big Cypress Swamp and Everglades National Park: Observe the fauna, flora and unique bird life of these two very different areas in southern Florida—November 11-18.

Louisiana Plantations: Tour the historic architecture and observe the processing of sugarcane; stay in plantation guesthouses—November 2-8.

Christmas at the Smithsonian: Enjoy a pre-opening look at new exhibits, dinner with Smithsonian leaders, shopping, and an old-fashioned tree-trimming party. Limited to 150 persons—December 7-9.

Hawaiian Islands: Petroglyphs, museums and a luau—January 1974.

Sturbridge Village, Massachusetts: A nostalgic winter weekend of sleigh rides, singing, square dancing and delicious food—January 25-27, 1974.

Baja California: Observe the gray whales, seals and sea lions from San Diego to Scammon Lagoon—February 4-11, 1974.

For detailed information on Foreign Tours, write Miss Bliss Schumann, Room SI 123; for Domestic Tour information, write Mrs. Patricia Kilkenny, Room SI 106, both at Smithsonian Institution, Washington, D.C. 20560.

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Museum of Natural History
"Synthetic Crystals" is a comprehensive survey of man-made crystals, showing how they are made, what they are used for and how they differ from natural crystals.

"Krause Paintings": The natural sciences are depicted in a collection of 20 works by noted artist Erik Hans Krause.

Museum of History and Technology
"Hall of Photography" presents the history of the art and technology of photography, using period settings and continuously scheduled demonstrations of early photographic techniques.

"Hall of Musical Instruments" presents demonstrations of early musical instruments daily, except Tuesdays and weekends, at 1:30 P.M.

The Henry R. Luce Hall of News Reporting features an audiovisual chronicle of the colorful history of American journalism (see August SMITHSONIAN).

National Air and Space Museum, Arts and Industries Building
"Balloons" tells the story of ballooning from its invention to its future possibilities. Included are the Japanese *Fu-go* balloon, sketches and photographs.

"World War I Fighters" is a habitat exhibit showing a reenactment of the capture of a Fokker D-VII. Also included are uniforms, medals and a commemorative exhibit on the Lafayette Escadrille.

Fall Museum Hours
After Labor Day, the Smithsonian museum buildings will be open from 10 A.M. to 5:30 P.M. daily.

Museum Reference Service
The Smithsonian Associates' Museum Reference Service is available to members traveling within the United States. Associates may write for a packet comprised of lists, by state, of many of our country's museums, galleries and historical sites. Brochures are included when available. Please specify the states in which you will be traveling. Allow at least three weeks for mailing. Write: Smithsonian Associates' Reception Center, Smithsonian Institution, Washington, D.C. 20560.

Traveling Exhibition Service
There are up to 70 different Smithsonian-sponsored exhibitions on display each month throughout the United States and Canada. For a complete listing and information on how to bring an exhibit to your area, write: Traveling Exhibition Service, Smithsonian Institution, Washington, D.C. 20560.
"Antwerp's Golden Age" is an exhibition of 179 objects selected from major museums in Belgium. The paintings, drawings, engravings, woodcarvings, bookbindings, medals and coins are organized to interpret life in a great Western European urban center during the Renaissance and the Baroque era. After its premiere in Washington, D.C., the show will tour 12 museums in the United States—opens Sept. 14, Corcoran Gallery of Art.

Woodcarving of St. Mark from "Antwerp"

- Norton, Mass.—"Hungarian Prints" (Wheaton College, Sept. 1-30).
- Omaha, Neb.—"Eighth Dulin National Prints & Drawing Competition" (University of Nebraska, Sept. 1-30).
- Pittsburgh, Penna.—"The Avant-Garde in Theatre & Art" (University of Pittsburgh, Sept. 8-Oct. 7).
- Austin, Tex.—"Molas from the San Blas Islands (II)" (St. Edward's University, Sept. 8-Oct. 7).

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By H. Allen Smith

When the braunschweiger dips, dig!

There is a radical deviation in the scientific approach to major human problems as one moves across our country from east to west and to the minuscule other parts of the world outside Texas' borders. On the Atlantic seaboard, for example, quality of water may be of great concern, but its quantity is not; in the Southwest, however, Man's search for *any* water has led him to more advanced methods of exploration, including the somewhat telekinetic science known locally as water-witchin'.

Since moving from New York to West Texas, I have studied this progressive branch of knowledge. And I am under the impression that in my community every second person is a qualified dowser.

Those possessing The Power are reasonably tolerant. When I told them I was a doubter, they smiled in the way of scientists in the presence of a boob. For my own good I have now learned how to respond when asked if I believe. I revert to old Leete True's answer when asked if he believed in infant baptism. "God, yes," he said. "I've seen it done."

I've seen it done with a forked peach stick and water was there. I've seen it done with the same stick and there was no water. I've been shown dowsing rods made of steel and of brass and of wire coat hangers, and I'm acquainted with a witch known as Woolly Butt Suggs because he uses a branch from the woolly butt tree, which is one of the many Australian eucalyptus trees.

There is a gentle-spoken witch in our town who is learned in the scriptures of gravimetric doodlebugging. He says dowsing originated in Germany, and that some of the early practitioners hung a braunschweiger sausage from a string and strolled about the meadows and when the braunschweiger began to twitch and whirl—*dig!* He tells me of Texans who suspend skeleton keys from copies of the Bible and find water, and a gentleman in Kansas who hangs a vial of cod-liver oil from his willow wand and gets what he calls a strike almost every trip out.

"Cath'lics," this man says, "ordinary don't witch, but back around nineteen-and-thirty a Cath'lic fella come through here with a thing he called his aspergizzlum—had holy water in the end of it—and he went and located some of the best wells we got over on Kokernot Mountain."

There are disputations on the post office steps about the finer points of the science. The philosophers talk of how most water witches obviously endure some kind of acute physical discomfort the moment their rods or sausages or skeleton keys or aspergillums tell them they've hit juice. Some go into dizzy spells, others become queasy in the stomach, a few throw fits. I have heard the more moderate local witches complain about a man in a nearby town who collapses and flops around on the ground the instant the rod is jerked earthward. "He overdoes," say his critics. "That kind of fit-throwin' gives witchin' a bad name."

Thus far women's lib hasn't infiltrated the brotherhood in West Texas. I've found only one lady who lays claim to The Power—the wife of a biology teacher. People laughed at her in the beginning, and then the family moved to a new house where even the plumbers couldn't locate the septic tank. She witched it up in three minutes and thereafter folks treated her with the respect she deserved.

The biology teacher himself can't get a tremble out of the rods. He keeps trying and can be seen tramping across prairie and dune, head thrown back in silent supplication, rod extended. He doesn't know that a basic law provides that only one member of a family can be given The Power. If, through sheer luck, he ever does witch up some water, it will be entirely too salty to drink.

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